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Popular Science

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By Wernher von Braun

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STANDARDS**
What's Holding Them Up?

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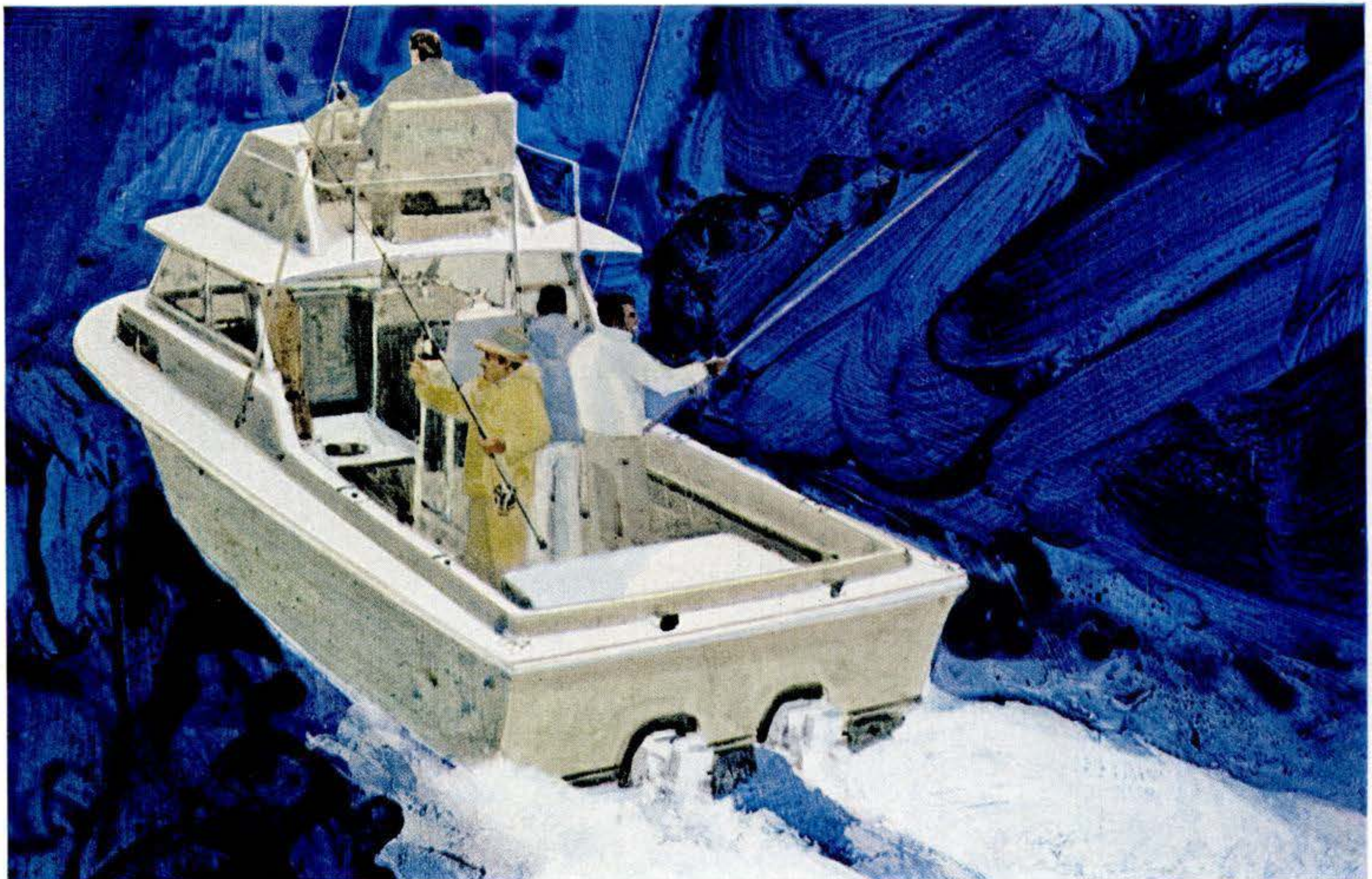
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It now costs us twice as much to train a telephone installer as it did ten years ago.

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Each of our training centers has a practice house. So a new installer can make mistakes on our wall, not yours.

There's also an 800-page textbook that suggests a right way to do everything.

Like leaving a small "drip loop" in the outside wire to keep water from running down the side of your house.

And drilling guide holes for screws so they won't split your baseboard.

And keeping telephone wires

a safe distance from electric wires to protect you from shocks.

With 20,000 new installers this year to be trained at full pay, you can see why we worry about the high cost of training.

Despite rising costs like these, residential telephone rates have gone up only 8% overall since 1961. And long distance rates have actually gone down. While the cost of living has gone up 37%.

Obviously, this can't go on.

Because the cost of providing you good telephone service is going up, telephone rates are going up, too—but based on the last ten years, far less than most things you buy.

AT&T and your local Bell Company.

1971
Consumer
Price Index
Up 37%

1971
Phone Rates
Up 8%
(C.P.I.)

1961



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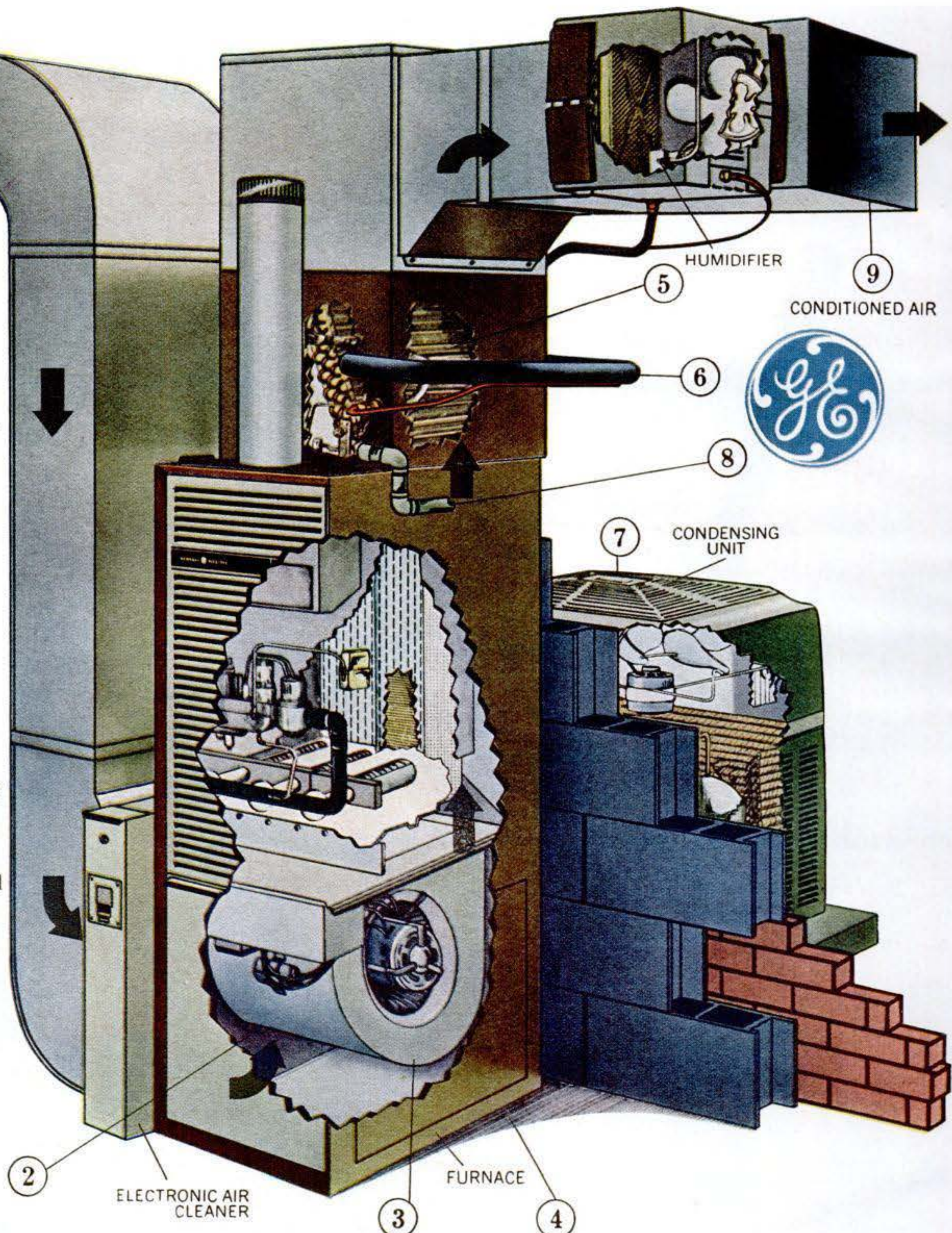
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Once you understand how central air conditioning works,

How central air conditioning works:

1. Hot, moist household air
2. is drawn through a filter
3. by means of a fan blower
4. located in your furnace.
5. It then passes through a cooling coil that absorbs the heat.
6. This absorbed heat is then passed on by refrigerant tubes to an outdoor condensing unit
7. where the heat is blown upward by a fan which discharges it into the outside air.
8. At the same time the heat is being removed from the house, the cooling coil removes excessive moisture and drains it away.
9. Clean, cool, dehumidified air is then circulated through the ductwork into every room of your home.

A thermostat, located in the living area, lets you select the temperature level you want.



Central air conditioning is one of the best investments you can make for your family. In terms of comfort, well-being, and good living.

Properly applied and installed, a central air conditioning system will give you cool air distributed evenly throughout your entire home. With proper care, it will give you years of reliable service and comfort. It could increase the value and salability of your home.

The cost could be much lower than you might think.

Particularly if you have a forced warm-air furnace to begin with. Because, for both heating and cooling, a fan and ductwork are required.

So if your house has an adequate forced warm-air furnace and ductwork, you're halfway there.

The purpose of these pages on central air conditioning is to help you make a wise investment.

We believe a careful reading will reward you well for years to come.

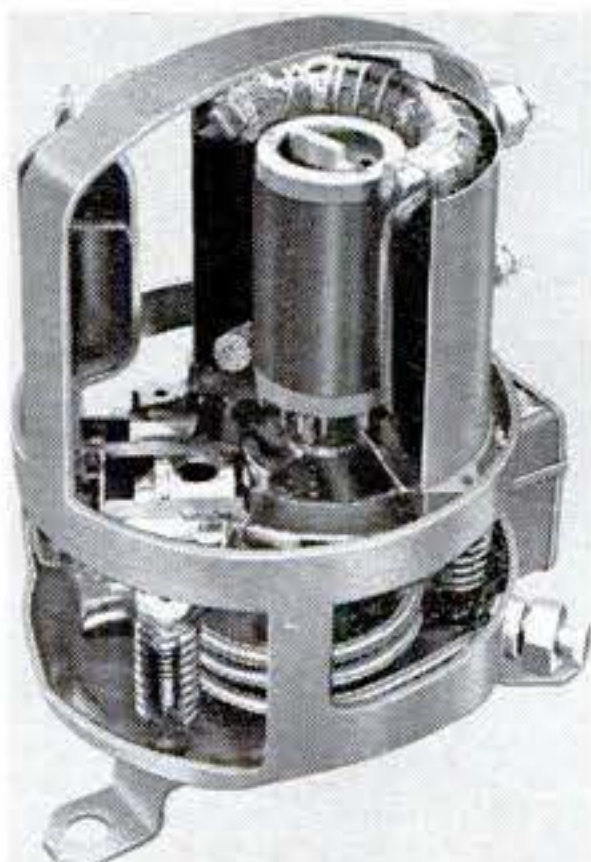
you'll understand why General Electric's works so well.

GE builds quality into its components.

From the preceding page, you know basically how central air conditioning works. Now if you'll consider our equipment, you'll learn about some of the quality we build in.

The GE Climatuff™ compressor has a remarkable record of reliability.

Every GE condensing unit has a GE Climatuff compressor, the heart of the whole system. This compressor has a remarkable record of reliability in over 500,000 installations. What makes it so good? It's designed for the job and manufactured with careful attention to quality. It has design features like a quick-acting thermal overload control to prevent motor burnout; a centrifugal oil pump for complete lubrication of all moving parts; internal spring mounts to cut vibration; and unique, super-strong motor insulation that resists refrigerant contamination and helps to withstand unusual voltage surges. All together, these features make a compressor that's the envy of the industry.



GE's efficient Spine Fin™ coils help prevent leaks.



Only GE central air conditioning units have Spine Fin condenser coils. The big advantage is that Spine Fin coils are permanently bonded to

continuous copper or aluminum tubing. This eliminates over 90% of the brazed joints, the spots where leaks can occur to cause failures. On an equal weight basis, they're almost twice as effective as conventional plate fin coils. That's why GE needs only half the weight for heat transfer surfaces as competitive units.

Now for the condensing units.

The Executive model can give you operating costs up to 15% lower than other compressor models of the same capacity. This is our top-of-the-line model, with an automatic two-speed fan so that it loafs along quietly on moderate days, but has plenty of reserve power to shift automatically into high air-flow on a scorcher to keep you cool and comfortable.

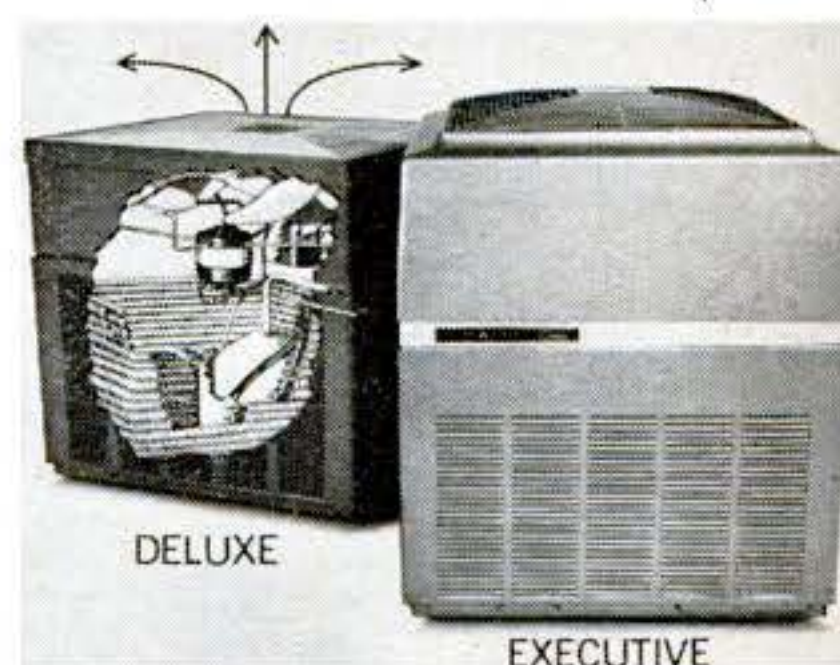
The Executive comes to you with a five-year Protection Plan at no extra cost. During the first year, under normal usage, there is no charge for parts or labor

(except for filters, exterior panels or grilles). During the last four years, a labor charge only for replacement or repair of covered parts. Parts and labor for repair to the compressor or leaks in the sealed system are covered for the entire five-year period.

We also have a Deluxe model that offers you matched component reliability. It features a classic appearance and a manually operated two-speed fan.

Our Deluxe model carries a one-year parts only warranty plus an additional four-year parts only warranty for the motor compressor. (Labor, diagnostic calls and local delivery of parts not included.)

Top air discharge is better. It means that hot air is directed upward; not sideways at the bushes. The noise is directed upward and not toward your neighbor's house. GE top discharge brings in air from four sides at low velocity which helps to prevent clogging of condenser surfaces with leaves, grass clippings, etc.



GE's National Service Contract.

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THE *What's New* MAGAZINE™

APRIL 1972 Founded in 1872/Vol. 200, No. 4

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NASA's New Wasp-Waist Mach I Airliner

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Ford's Dream Car You Can Buy—Now! PAGE 72

Pantera is the nearest kin to an all-out racer you can legally drive on highways.

Bicycle Camping—What You Need to Know PAGE 96

Here's what you'll need, what it will cost, and where you can get it.

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Outboard-motor pollution

In "New Outboards: Better Neighbors Than Ever" [Feb.], you say that Environmental Engineering, Inc., reported that "new outboards are clean." You know and I know that the two-cycle engine is the most polluting method of burning fuel, especially in performance-designed engines. To say they're non-polluting defies logic and engineering integrity. My guess is that one 50-hp outboard spews out more pollution per mile than does a modern jetliner—and there is no comparison in their ability to provide transportation.

R. I. PATCHIN, Villa Park, Calif.

Big Three car companies

Re "View Down the Road" [Feb.] regarding the breakup of General Motors: Everyone forgets that size and the number of cars manufactured per year are what keeps costs down. Even American Motors benefits from GM's size. Break up GM and car prices would climb immediately.

GALE IRWIN, Rolling Hills, Calif.

Sodium silicates in detergents



As a leading manufacturer of sodium silicate, we would like to comment to your readers on "The Detergent Mess—What to Tell Your Wife" [Jan.]. Sodium silicate is not a novel ingredient to "beef up" low-phosphate formulations. It has been used in practically all the changing types of home laundry soaps and detergents for more than a century. Its normal purpose is not to serve as an anticaking agent, but to contribute such benefits to laundering as dirt removal and suspension, corrosion protection, and alkalinity control. Phosphate-free detergents do not necessarily contain any more sodium silicate than phosphate detergents. Sodium silicate, which is safe in phosphate detergents, does not become "caustic" when the phosphate is omitted.

Alkalinity is not the only potential health hazard in detergents. You will find detergent products that bear warning labels, even though they contain no

"caustics" at all. Safety depends on the nature and amount of all the ingredients.

WALTER SCHLEYER, Philadelphia
Quartz Co., Philadelphia, Pa.

Are plastic domes flammable?

Author Richard Day's statement that plastics may be on the way out for dome home construction is untrue. I'd like to know more about said dome that burned to the ground in five minutes. I find this incredible, because polyurethane is rated from self-extinguishing to nonburning. The Geodesic Dome Co. of Los Angeles has successfully tested polycarbonate as an unbreakable, clear, self-extinguishing plastic for dome construction.

ROBERT SUBA, Port Plastics, Inc.
Montebello, Calif.

Day replies: "Plastics were in disfavor among the domers I talked to for the reasons I gave in the story. While urethane foam is rated 'from slow burning to self-extinguishing,' my sample burned aggressively until it was only ashes. If you plastics people can come up with a reasonably priced structural insulating material for do-it-yourself application in dome building (with the fire safety of most present polystyrene foams), you should be back in the picture real fast."

Warning for dishwasher fixers

"Secrets of Keeping Your Dishwasher Trouble-Free" [Jan.] was great, but you neglected one point. Certain units, like the Frigidaire and Wards, have starting relays that depend on gravity to function properly. When troubleshooting involves running the motor with the dishwasher on its side, the starting relay will not de-energize, thus causing the motor starting windings to burn. The motor can be run with the dishwasher on its side if the starting relay is oriented with TOP (marked on the relay) up. I learned this the hard way and thought I should pass it on.

DANIEL PALMER, East Hampton, Conn.

Unlocked power tools

About the article "How Electronics Can Lock Power Tools" [Dec. '71]: I built the unit and it performed as the author said it would, but mine has one negative characteristic that defeats the whole purpose. If all switches—S1 through S10—are closed simultaneously the relay closes. This won't fool anyone very long. Have you made an error?

HOWARD WORTHINGTON, Oxford, Mass.

Yes, we have. The remedy is simple:
1) Jump a 390-ohm, 2w resistor across



Goodyear GLAS-GUARD, the double fiberglass belted tire specially made for Pickups

Bruise and cut-resistant rubber in sidewalls

Thick, long-wearing
rubber tread

Two shock absorbing
fiberglass belts

Exclusive "layered"
construction keeps each
belt sandwiched
between two layers of nylon
plies—holds the tread firm
against the road

Four rugged nylon plies

It's big on the road.

The fiberglass belts fight treadwearing squirm to give you long mileage.

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And the GLAS-GUARD tire is also big off the road. Where rocks, ruts, potholes and stumps lie waiting. GLAS-GUARD's tough nylon body, combined with the fiberglass belts, wards off the blows.

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The quality performer handloaders prefer.



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Swift and sure ignition. Two things handloaders demand in the performance of their center fire ammunition and shot shells. That's why our non-corrosive, high-stability primers — the heart of the load — are sought by experienced shooters who custom-make their own center fire loads and shot shells.

Winchester-Western Staynless Primers have been tested under all conditions at temperatures ranging from minus 40°F. to 115°F. Handloaders share the positive results of thorough research — an ignition that's lightning fast and uniform. These quality primers are the result of the same exacting process that has made Winchester-Western loaded ammunition world-famous. Now they're part of the best available matched components system for those sportsmen who "roll their own." **WINCHESTER-WEAVER**
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want it

PS Readers Talk Back

[Continued]

R1. 2) Remove the jumper between pin 6 and pin 4 on IC 3. 3) Disconnect the wire on pin 1 of IC 3 and reconnect it to pin 6. That should solve the problem.

That one-gun color-TV tube

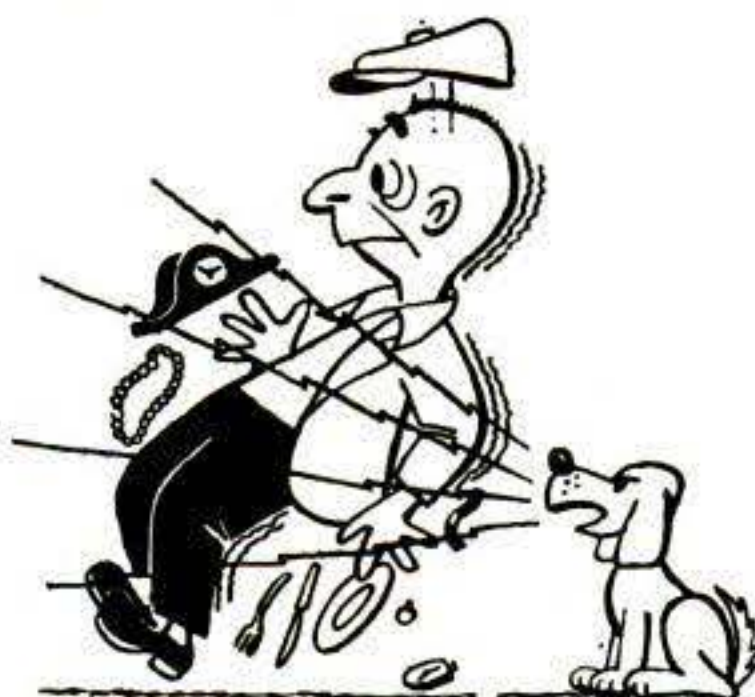
One amazing thing about "Uniray—Amazing One-Gun Color-TV Tube" [Feb.] is its apparent similarity to the Sony Trinitron color-TV tube, which has been available in this country for a couple of years. Isn't it true that both tubes feature the single gun and vertical phosphor triplets? If so, then what's new about Uniray? Can you elucidate?

DOUGLAS HOECKER, Norfolk, Va.

The Trinitron tube does have one electron gun, but—like the shadow-mask tube—it has three separate beams. The beams are in a straight line rather than a triangle, but—again like the shadow-mask tube—the Sony Trinitron is arranged so that each beam can strike only one color of phosphor. This system's big advantage is that it does not need dynamic convergence, but it's still rather complex and expensive.

The new Uniray tube has only one beam, which strikes all three colors of phosphors. The trick is in letting the beam "know" which phosphor it is striking at any given moment, and this is where the unique indexing system described in the article comes in.

Little dog with a big bite?



I have an addition to make to "A Chain Reaction Burglar Alarm—Its Bark Is Worse Than Its Bite" [Feb.]. Record the dog's bark at 7½ ips on a reel-to-reel tape recorder and play it back at the slower 3¾ speed. When it's played back, everyone will listen—including the dog. I did this with our Dalmation pup, and he sounded like a St. Bernard.

RAY ZIESMER, Port Edwards, Wis.

Low-cost home welders

A while back you tested a small gas welder. The article said it would be a very good buy for someone who had use for an inexpensive welder. I'd like to buy a low-priced welder, but prefer electric to gas, so why not test one of the cheaper electric ones?

BERT ORBAN, Mogadore, Ohio

PS is right on the ball: See page 82 in this issue. In "Two Home Welders That Really Work," E. F. Lindsley tells all about Ward's new \$55 "sputter box."

Motor made from a record

With the encouragement and facilities of the Hayward High Science Dept., I built this slightly modified Poggendorf



electrostatic motor ["Electrostatic Motors You Can Build," May '71]. I solved the materials problem by using an old Sousa record, glass tubing, a few clothes hangers, and Styrofoam packing.

DON SAHMS, Hayward, Wis.

PS shot down in dogfight

In "Space-Age Dogfighting—It's a Wild New Ballgame" [Feb.], there's a photo (page 76) in which the author is supposedly taking a picture of an F-4 "zinging by." The tail assembly and the delta wings prove that it's an F-106 and not an F-4.

JOHN DORSEY, Hampton, Va.

You're right, John. Several other readers zeroed in on us. Aren't you glad the editors aren't fighter pilots?

Those noisy auto alarms (cont.)

Re Henry Hulme's letter in Readers Talk Back [Feb.]: We've been making the type of alarm he suggests for some time. It is self-resetting (reset time of 1½ minutes), has electronic-sensing circuitry, uses high-quality components, and can be custom-modified. It sells for \$129. We agree with Mr. Hulme about the disadvantages of a continuously sounding siren. Our alarm system solves the noise-pollution problem and offers features every alarm should have.

DOMINIC E. BOTTARO, Totaltron Laboratory, Watertown, Mass.

... Henry Hulme's letter suggested a time relay to cut off a siren-type auto alarm. Just recently, my grandfather and I designed and constructed a relay of this type. If a thief opens one of the doors, the siren sounds instantly. Our relay lets the siren run for half a minute and then shuts it off. If the door is left open, the siren starts again after another half minute. As long as the door stays open, it would cycle off and on. If the thief closes the door, the siren stops after the first cycle. Our system would cost about \$15 for parts only.

PAUL DUMKE, Milwaukee, Wis.

Want to get something off your chest? Write "Readers Talk Back," Popular Science, 355 Lexington Ave., New York, N.Y. 10017.

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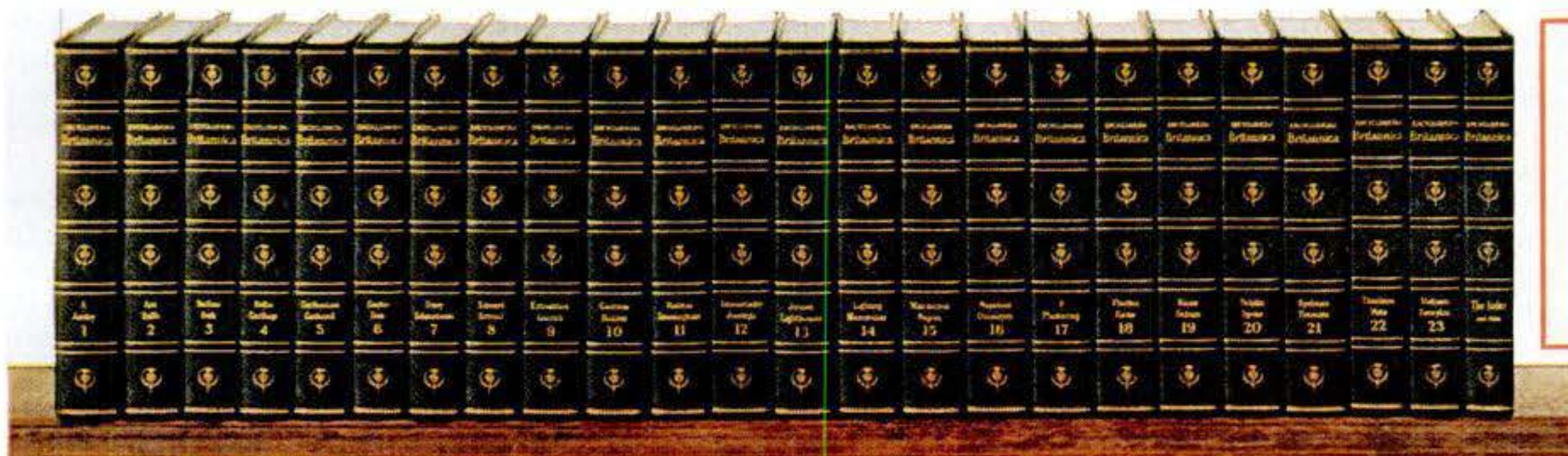
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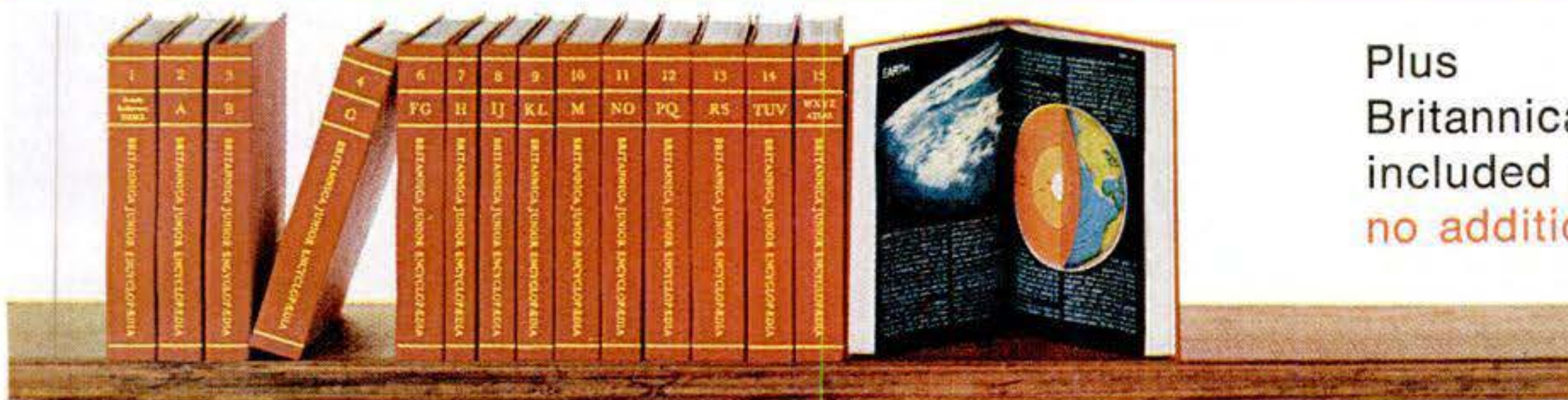
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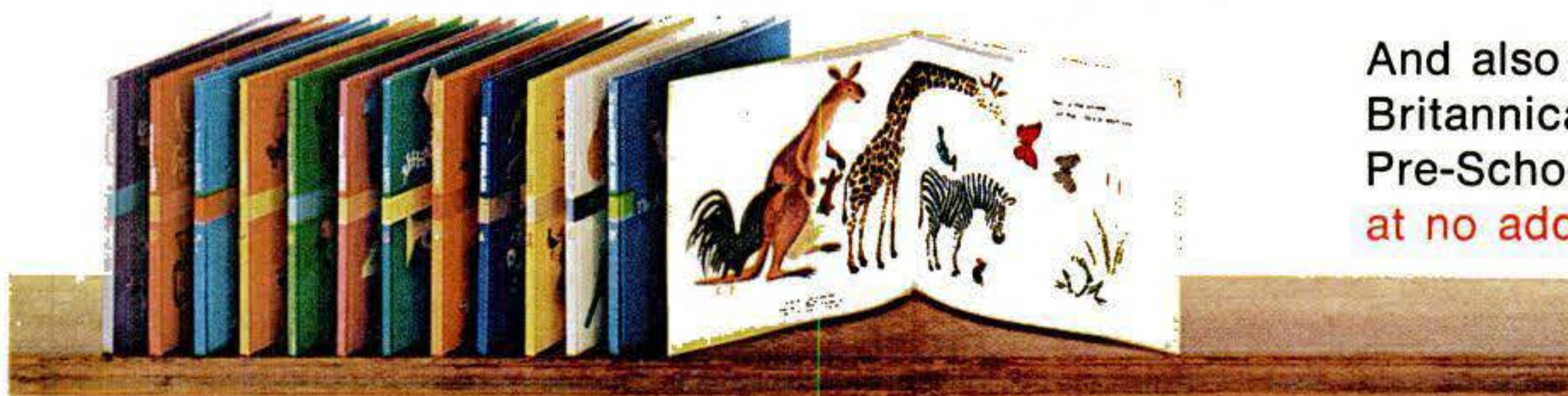


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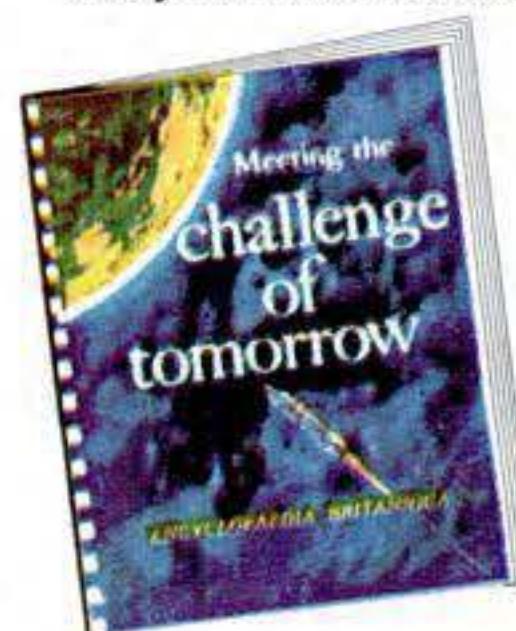
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Detroit Report...

By JIM DUNNE / PS Detroit Editor



GM tires for GM cars—an end to wandering warranties?

It appears certain that GM will equip its new cars with its own brand of tires within the next three years, soon thereafter to be followed by Ford, Chrysler, and American Motors. That means the car makers would also guarantee the tires (up to now, you go to the tire dealer, not the auto dealer, for tire-warranty claims). A high GM official says, "What the hell, we warranty fan belts, and we don't make those." Under the auto-company plan, the tire companies will continue to build the tires, but the names Goodyear, Firestone, etc., will not appear on the sidewalls. They will be replaced by "GM," "Ford," etc. Warranties? They'll become the full responsibility of the auto companies through their dealers when this plan matures.

Radial tires make new inroads

GM has been wary of the radials for a long time, but is beginning to come around. Radials will appear as standard equipment on some '73 GM car lines. Look for Monte Carlo, Grand Prix, and Eldorado to be the first to wear the long-wearing, high-traction tires. It's expected that all five major tire companies will supply GM's requirements, but B. F. Goodrich appears to have the inside track—at least for the Eldorado. If those three specialty cars go to radials, Toronado and Riviera are expected to follow suit.

Tire experts say the steel-belted radial will be the dominant tire in the next few years, at least for high-performance cars. Even stronger cord materials have already been developed, however. Yet the public likes the idea of steel best—an opinion based on its reputation for great strength—so the tire companies are not yet pushing the newer materials in tire promotions. Ford has steel-belted radials on many of its present lines, and Chrysler and American Motors are expected to make them available in 1973 as options on certain car lines.

Front-drive commercial vehicles

GMC has designed an all-purpose chassis that could serve a number of roles, including motor homes and minibuses. The chassis was originally designed for a downtown bus, a sort of minibus used to shuttle passengers for short runs in high-traffic areas. But GMC engineers soon discovered that the chassis was adaptable to other purposes as well. With a front-drive power train, it was easily adaptable to the motor-home business, could be used for delivery vans, and would make a new type of ambulance. Use of the platform for a small fire engine was also proposed. This all-purpose project has already spawned GMC's new motor homes—23- and 26-foot sizes that will be introduced in December.

Aluminum auto bodies

Is aluminum a bigger threat to steel sheet metal than plastic or molded fiberglass? Could be. Aluminum skins on car bodies may make a comeback, but the earliest applications are 18 months away. Automotive designers are taking a long second look at the lightweight metal for car bodies, especially for the heavier cars now scheduled for production in 1974 and later. Aluminum companies fully expect that their metal will be used for hoods and trunk lids on some smaller cars in the 1974 model year. Later the applications will spread to other models.

Aluminum is especially important in small cars because safety and emission systems put too much load on the low-powered engines now used in these cars. Detroit figures that air bags, emission controls, protective bumpers, and other required components will add hundreds of pounds to the average car while cutting the horsepower. On a small car, that means an added weight of 10 percent or more.

The end of the oil change?

GM's Wankel-engine debut in late 1973 will cause a revolution in the nation's oil business. GM plans to change the specifications for the oil in its rotary engine, calling for a much less expensive type of oil than in present cars. GM scientists point out that the oil used in the Wankel does not require a number of expensive additives to fight sludge, foaming, rust, and other effects of a piston engine's blow-by gases.

Instead, a much simpler oil formula will do the trick of lubricating the seals and cooling the rotor. In fact, GM designers say the oil could eventually be combined with the automatic-transmission fluid in one common system. GM is also weighing the merits of extra-long intervals between oil changes—perhaps as long as 50,000 miles. The company has virtually decided to extend the interval to

24,000 miles when the rotary engine is introduced. Top-off quarts added every 1000-1500 miles would keep the oil fresh, and simply changing the filter would insure keeping it clean.

End of the ring job, too

The parts in the Wankel engine that wear out first are the apex seals. Current production engines from Germany and Japan get between 60,000 and 100,000 miles in a set of seals. It requires a major overhaul of the engine to replace the seals on present Wankel engines. But GM now claims to have this problem licked—in two different ways.

GM has seals that will last for 400,000 to 500,000 miles. And changing the new seals can be as simple as changing blades in an ejector razor—slide out the worn seals, push in the new ones. GM is developing a low-cost seal that will remain effective for at least 100,000 miles. Then, when replacement seals are inserted, the owner has a virtually new power unit, since there is very little wear on any other components in the rotary engine.

Industry acts on anti-theft

Eighty percent of car thefts in 1971 were performed by 15- to 21-year-olds. And 400 thefts were committed by youngsters under 10 years old. Those are the statistics cited by Chrysler Corporation at the unveiling of its new anti-theft locking system, to become an option on certain 1973 model cars. Chrysler says its new system will help prevent all known types of illegal entry to locked cars, "short of a dynamite explosion."

The system flashes the exterior lights and honks the horn intermittently to warn that the car is being tampered with. It is triggered when the car doors, hood, or trunk lid are being opened illegally. In addition to this option, all 1973 Chrysler products will have a much stronger trunk lock to prevent forced entry into that compartment. Punch-out, prying, and sheet-metal twisting will not open up the new locks, says Chrysler.

Radar sets are almost sure bets

To be installed on cars of the late 1970s: The auto industry is itching to get a workable radar system that will scan the roadway ahead of a car. One of the latest uses is as a trigger system for inflating air bags. The radar will record the closing speed of the car on another object. A computer would decide if a crash was imminent, then signal the air bag system to inflate. Radar can also be hooked up to the braking system and slam on the brakes if a collision is about to happen. Mated to speed-control systems, radar will regulate the movement of a car so that it will safely trail the car ahead, speeding up and slowing down in unison with traffic flow automatically. A system of this type will be a real life-saver, working automatically to stop the car when the roadway ahead is blocked. PS



A machine famous for not breaking down.



1972 Maverick 2-door Sedan
shown with optional Accent
and Protection Groups, white
sidewall tires and tinted glass.

Seems like most machines you buy today end up costing you more money just to keep them running. That's what makes Ford Maverick so exceptional. Maverick is a simple, uncomplicated machine —so there's less chance of *anything* going wrong. What's more, a good-looking, family-sized Maverick can be yours for surprisingly little money. Standard 6 or optional V-8. 2-door, 4-door or sporty Grabber.

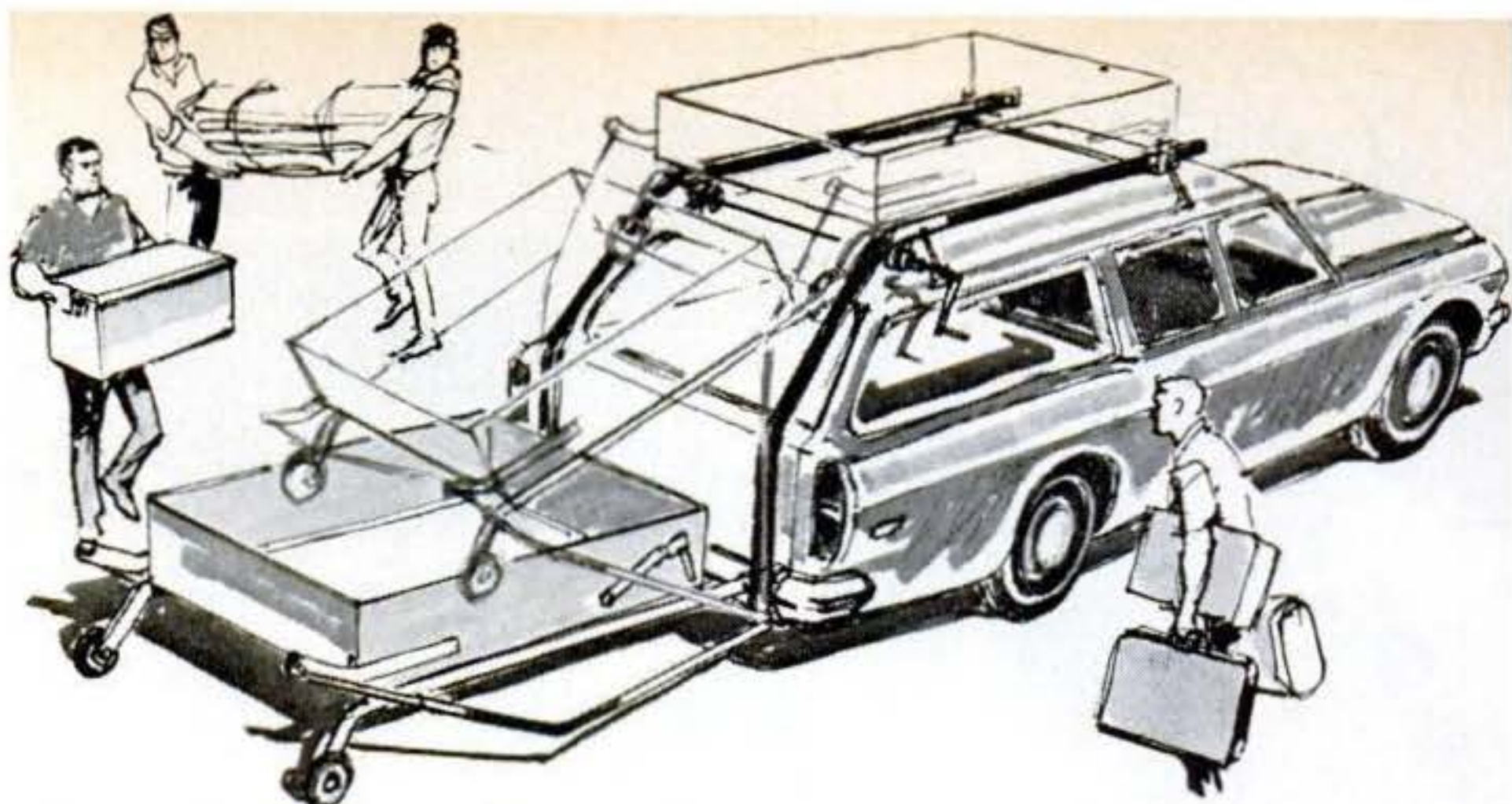
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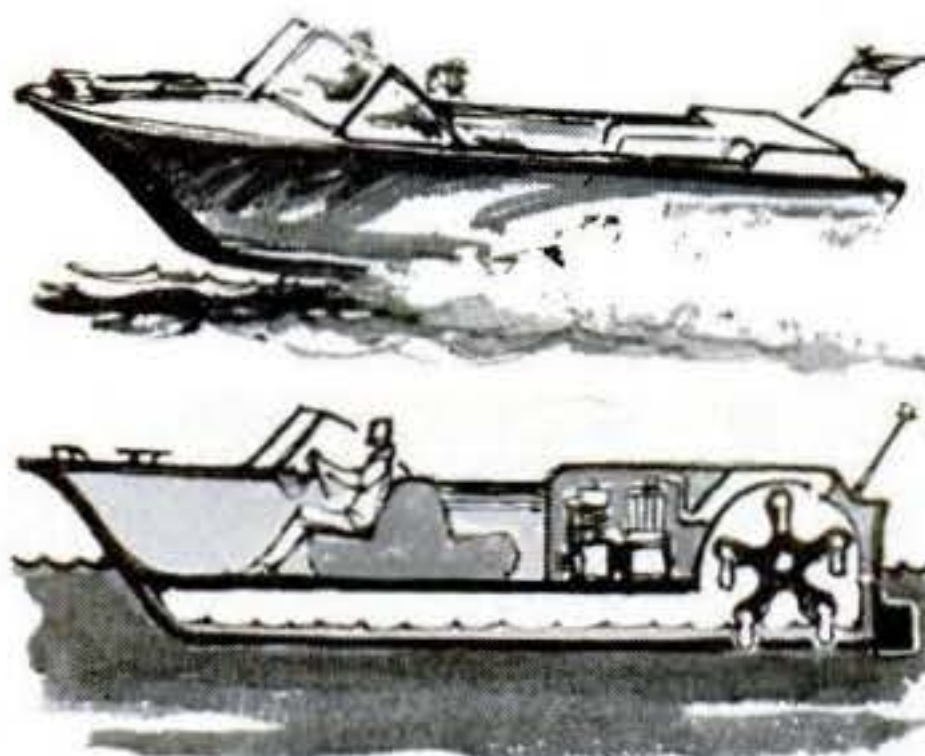
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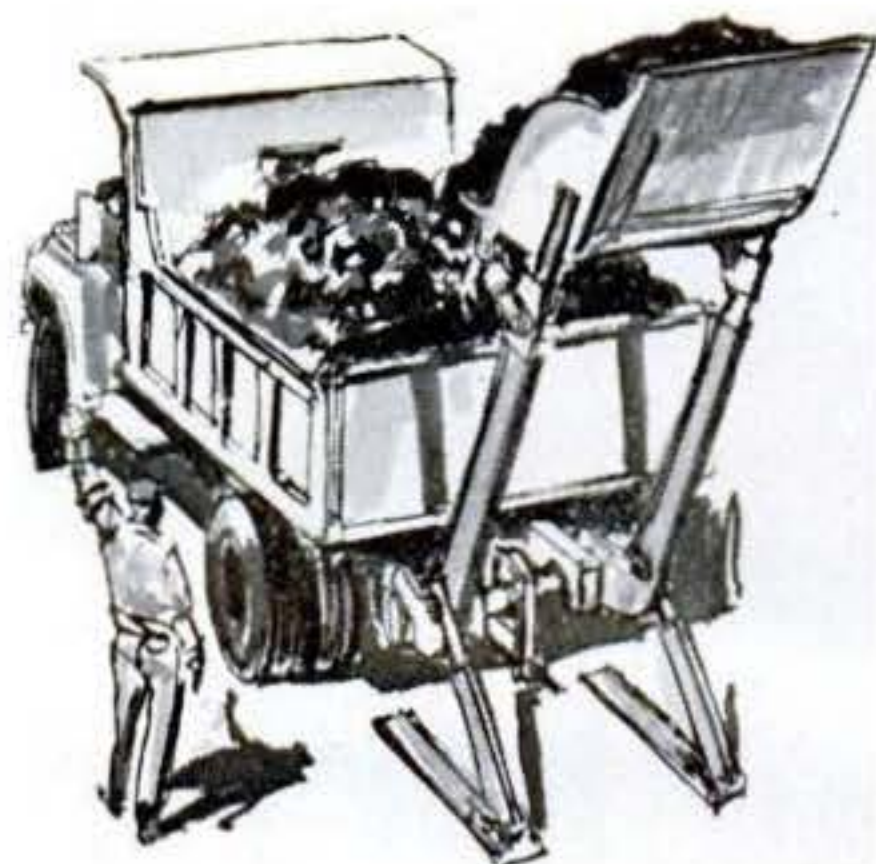
Car-top rack rolls down. You could stow or unpack camping gear without straining or stretching if you had this recently patented carrier on your car. Tracked in adjustable, clamp-on, bumper-to-car-top rails, the wheeled carrier could be easily winched up or down. Its let-down wheels would partly level it on the curved tracks, let you roll it away for loading or campsite storage.



Projectile lights up hideout. This ball-size flare might reduce danger to law officers tracking armed fugitives. Tossed into a suspect area, the delayed-action, battery-powered projectile would light a flashbulb, a blinker, and a steady light to illuminate the hideout but not the officers' position.



Air cuts boat drag. With compressed air acting on five crank-linked paddles, says this inventor, a small engine could deliver big-engine power. Each blade would knife the water vertically. Expelled air, contained by the hulls and a hinged bow shield, would buoy the craft, reduce friction and drag.



Truck wheels power loader. Coupled to the rear of a dump truck, the bucket on this loading attachment would scoop when the truck backed over its trestle, then lift and dump when the truck inched forward. It could load a number of trucks or hook onto one, in raised position, for over-the-road travel.



Drill trims lawn edge. Chucked in the jaw of an ordinary electric drill, this shielded cutter could quickly trim hard-to-reach lawn or hedge borders. Grass would be fed into the rotating blades by a projecting lip on the guard. The drill, strapped to the handled, skate-like carrier, could be walked and guided more easily than the usual hand-held trimmer.



Spray warns of splash. A remotely controlled sprinkler would not douse passersby on a lawn, park, or golf course if it had a spray head like this. Water rising to the head would raise a spring-loaded piston, compressing air in a cylinder. Before water could reach the outlet, the air would blow a whistle to warn anyone nearby of an imminent dousing.

The following patents have been issued on these inventions: Let-down rack—No. 3,531,006 to Roy H. Farchmin, St. Paul, Minn.; Timed flare—No. 3,596,078 to John C. Owens, Bedford, Ind.; Air-drive boat—No. 3,528,381 to Wyly K. Crowder, Pontiac, Mich.; Truck loading attachment—No. 3,527,370 to Ralph E. Allen, South Portland, Me.; Lawn and hedge

trimmer—No. 3,530,653 to Vivian L. Ott, Norfolk, Va.; Sprinkler alarm—No. 3,570,447 to Mark T. and Paula T. Basseches, Scarsdale, N.Y. Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington, D.C. 20231, at 50 cents each. To write to an inventor, address him (by name and patent number) in care of the Commissioner.

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"Say, Smokey—"

A clinic on cars by America's most famous mechanic

Each month in POPULAR SCIENCE Smokey Yunick answers questions on cars—family cars, high-performance jobs, hot rods, and racing cars—selected from those sent in by readers. Got a problem? Send it to: "Say, Smokey—" Popular Science, 355 Lexington Ave., New York, N.Y. 10017. Questions cannot be answered by mail.



Our '69 Chevy Townsman wagon runs very well around town, and gives us good mileage. However, on the turnpike at 65-70 mph, it uses a hell of a lot of oil. A compression test and a plug test showed nothing wrong. Somebody suggested that the oil might "bubble-up" at high speed and come out. Can you suggest anything?

SOL HALPERT, Miami, Fla.

Can't do you much good when you didn't mention which engine it is—little V8, big V8, or six. All three have their own peculiarities. Generally speaking, abnormal oil consumption at high speeds is caused by three things: high crankcase pressure from inefficient ventilation that causes oil to blow by the rings; too much oil being sucked past valve stems into the combustion chamber because of bad valve guides; worn or sticking rings that make loose wall contact at high-speed operation.

After months of checking brands and names I'm still full of questions about radial tires for my 1968 Firebird. Why are manufacturers changing from 14" to 15" wheels on many new-model cars? If I bought a new Pontiac that has 15" wheels on it, is there any reason I couldn't put my old snow tires and 14" wheels on it, providing the bolt pattern is the same? On the car with radial tires could I, for example, use an F series up front and an H series on the rear, or should they be all the same for the best handling? I'm wondering what to do about snow tires—can different brands be used if they're radial ply?

KENNETH HOLLAND, Quincy, Mass.

The 15" wheel is a better deal, because brakes and tires are stronger and last longer than the old 14" size. Yes, you could use 14" snow tires, but you lower the final drive ratio, and your speedometer will read fast and the engine will rev faster to achieve the same road speed. You can mix front to rear tire size and brands, but it's a tricky business unless you know all the characteristics of the tires and are a chassis engineer, and match up the tires front to rear in respect to their performance for a stable ride. The best solution is NOT to mix.

I'm tired of jumping in and out of my car to start it every time I do a tune-up.

Isn't there some way I could make a switch cable that would accomplish the same thing from under the hood of my 1966 Ford 289? If you can tell me what gets jumped to what for the starter solenoid and the ignition, I can take it from there.

R. S. REYNOLDS, Richfield, Maine

Put 12 volts to the primary on the coil and 12 volts to the energized side of the starter solenoid and you have it. Hope you don't do this some time when the car is in gear!

We have a 1972 Vega wagon with a standard engine. It runs well when warm, but requires repeated cranking to start the engine when cold, or in the morning. Once started, any shift from P to R or D will cause the engine to conk out. The dealer's shop manager says it's the antipollution device, which needs to be warmed up before shifting. There is nothing wrong with the car, he adds. Is this true?

ANTONY MARR, Branford, Conn.

The stalling is carburetor trouble caused by the tight emission standards, which force the carb design to stay way over on the lean side. So part of what the dealer said is true. But I don't agree with him that this is normal. When the carburetor is just right, it won't do what you say. Unfortunately, the type of mechanic who knows how to break that condition is damn near as extinct as the bald eagle. As a matter of fact, it's more than a mechanic's job. The solution is just a little more fuel, but only when you transfer from the idle to the intermediate fuel system. So go back and have the dealer recheck the carburetor and all the latest bulletins from Chevrolet for data on "start-up stall."

I have a problem with fuel consumption on my 1970 Olds Cutlass 350-c.i. engine with four-barrel carb and 45,000 miles on the speedometer. I got 22 mpg on highways and 17 around town in Vancouver at sea level. When I moved to Edmonton, at 3,000-foot altitude, the gas mileage in town dropped to 11 mpg! I recently had a complete tune-up with timing checked, compression okayed and a carb overhaul. Could they have messed up my carb, or is this the right mileage for higher altitude? Also the water tem-

perature at normal idle, which was 210 degrees when the car was new, has dropped to 170 degrees. Do the spark plugs have anything to do with the changed conditions?

F. CHUNG, Edmonton, Alta.

The altitude hurt your power and in effect overgeared your engine, and it's now lugging. The carburetor power valve stays open much longer. The increased altitude makes your carburetor somewhat richer, and I would guess that the terrain is more hilly than where you were before. Cooler water temperature hurt the mileage a little because the higher engine temperature was vaporizing the fuel better than now and probably helped fuel distribution. The correct plugs are important, and do affect mileage. Also, incorrect settings made during your carb overhaul could easily have made the fuel richer. Make sure timing is correct and that the advance is working all the way up.

In a recent column you agreed with a reader that it was bad to race a cold engine when starting up. I have a 1972 Chevrolet Impala with 400-c.i. engine, and the specs call for 2,200 on the high-speed-idle cam. It stalls repeatedly unless I warm it up for 30 seconds or so at fast idle. What will this do to an engine that is frequently started in the morning below 30-degree temperatures? Can this fast idle be reduced?

J. D. HALLENBECK, Wilmington, N.C.

It certainly is not good to start a cold engine and immediately turn it at 2,200 rpm. It seems to take a few seconds for oil to get under pressure in all of the engine areas. I would suggest a heated garage, or a plug-in-type engine heater for a real fix. You could reduce the fast idle, but I believe this would aggravate your cold-starting problem.

You have told us what lubricant to use when reassembling an engine. What should one use in reassembling a differential and stick transmission? I have been told to add liquid Moly, but not to add it to the overdrive. What can you tell me?

MARVIN O. ADAMS, Los Altos, Calif.

Use a good gear oil in the transmission, and limited-slip rear-axle grease for differentials. Almost any lube will be fine in the transmission or differential because the problem is different than in engines. I usually assemble the transmission or differential dry—except for hidden or blind bearings and spaces—and fully lubricate after assembly.

I read recently about Jet-Fire fuel igniters, supposedly good for any engine and guaranteed for the life of a car. Installed on a car like my 1970 Olds Delta 88, they are claimed to produce 30 more horsepower and as much as five miles more per gallon on regular gas. Would they do this, or would they harm the engine?

BOB KOSKOCKY, Port Colborne, Ont.

I don't believe anything would happen, good or bad—unless you gain a bad temper from the change. If you do put in a



John Deere quietly introduces the first Electric Riding Mower. No exhaust. No exhaustion.

Here's the riding mower that sets you free from gasoline-engine care. John Deere's new Electric 90 purrs along on clean, quiet battery power. No gas and engine oil to check or add. No tune-ups, filter changes, or carburetor adjustments. No engine heat and vibration. Its "switch-on" starting is as easy as turning on a light. Mows an acre (often more) per charge. Recharges from your home outlet. Needs only about 7 cents' worth of electricity to cut an acre of lawn. And the purchase price is far less than an electric tractor costs. From now on, mowing your lawn

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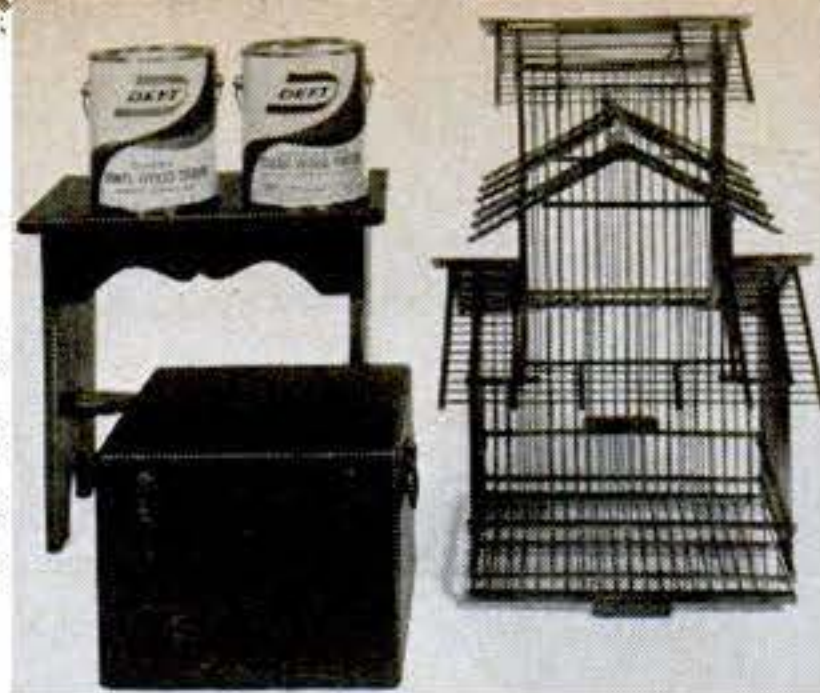
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"Say, Smokey—"

[Continued]

set, and the old plugs you take out are in good shape, I suggest you save them.

The manifold on my '69 Dodge Dart has broken above the manifold heat-control valve. Two vertical gaps in the side about three inches long release large amounts of exhaust into the engine area, and some gets into the car. Can this be fixed without replacing the manifold?

G. KORBELL, Euclid, Ohio

Short of replacement there's no way I know to repair that. But when you've installed the new manifold, try to keep the damper lubed so that it's free to move.

Would adding antisway bars improve the handling and safety of a motor home—especially in a crosswind or on rough roads? Will they affect the ride of the vehicle? Should an additional transmission oil cooler be added? Is it possible to overcool the oil in cold weather?

JIM HACKETT, Lancaster, Pa.

Motor homes seem to need all the anti-sway aids we know about—and then some. I doubt if a sway bar would harshen the ride. Look at your tires to make sure they're big enough to handle the load. Good, heavy shocks help, too, but also affect the ride. I think you need an oil cooler if the fluid temperature goes over 275 degrees F. Oil temperature under 100 is too cold.

At about 63 to 70 mph there is a pronounced vibration and steering-wheel shake in my '68 Ford LTD. Above 70 and below 63, the vibration is reduced but it's still there. The front end has been aligned and all wheels balanced, but the problem persists. It started after I switched from the 8.45x15 O.E. tires to Montgomery Ward belted tires, size G70x15. Soon after the problem developed, I returned the tires to MW for inspection. Three of the four were found out of round and replaced. Still no good.

JOHN C. MORI, Rio Vista, Calif.

I think your tires should be trued, then balanced. Or try to borrow a set of known-true tires and wheels from a similar car and try them. If the borrowed tires cure the problem, it's back to the tire people for a solution.

PS



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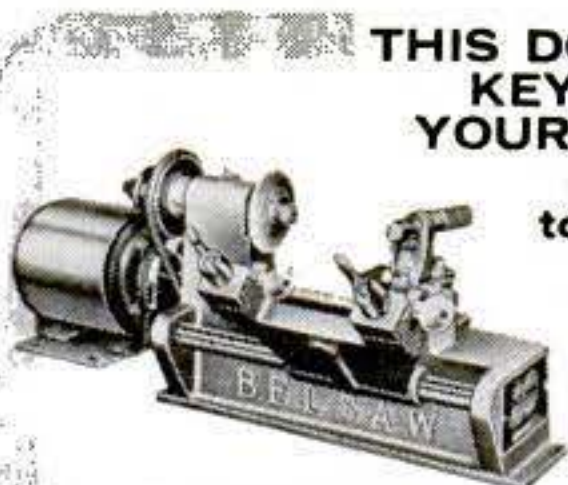
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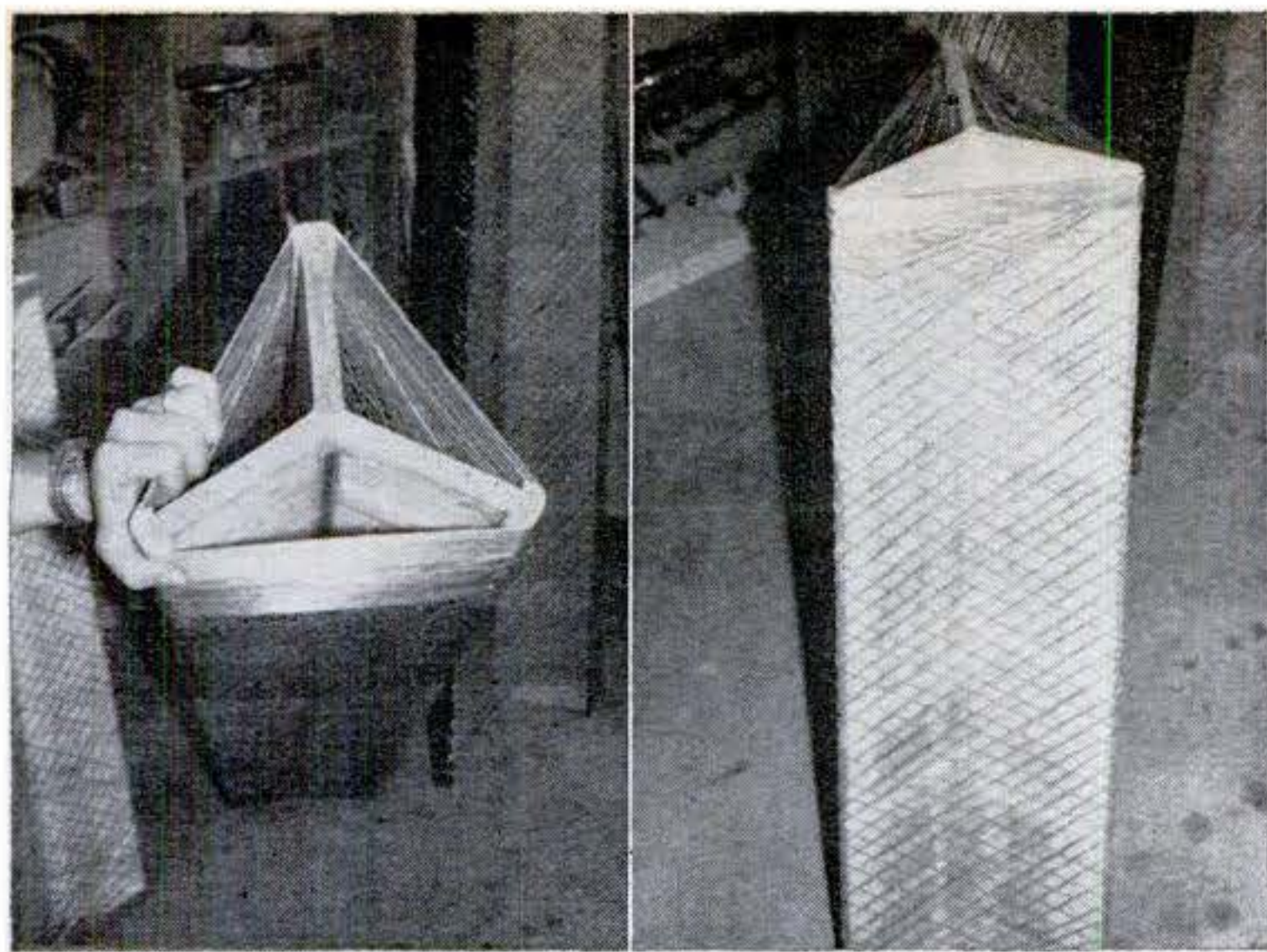
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"It's a deal. You flunk my wife and I'll flunk yours."



Simplest captive column is formed of a three-armed linear core. Along the outer edge of each arm runs a stiff rod, and wound around the whole package are two angled filament courses.



Captive columns take to the sea in the form of a lightweight, almost capsizes-proof trimaran. All three hulls and the single connecting beam are formed of fiberglassed captive columns.

Bantamweight Column Takes Heavyweight Loads

By JIM DAVIS / PS West Coast Editor

Take a 20-foot beam weighing just three and a half pounds. How much weight do you think it could support? Would you believe seven tons? Well, you better believe it. In recent tests, a new type of beam called a captive column did precisely that: It supported a seven-ton tractor, deflecting a matter of a few inches. When the weight was removed, the captive column returned to its normal position.

What is a captive column? It's a new concept of construction patented by Lawrence Bosch, of San Jose, Calif. In its simplest form, a captive column is made up of three triangular segments that form a single triangular beam.

If you want to, you can easily make one yourself. Start by making a core to run the full length of the column. Choices for core material are wide, but we'll use wood. Take three similar boards and join them at the edges into a pattern like the familiar three-pointed Mercedes star.

Along the outer edge of each board, run a stiff rod. This can be metal, bamboo, or fiberglass, fastened in place with adhesive, screws, or nails.

Now you wrap the package with a filament, usually fiberglass. The filament goes on in two courses wound at opposing 45-degree angles. The purpose of the filament wrapping is to lock all the elements of the beam

together. It prevents movement of the rods with respect to the core, and prevents buckling of the beam.

With the filament bonded in place, you have a hollow beam capable of handling tremendous stresses.

What is the secret? All its elements work together under load. For example:

When used as a beam with the load at the center, the core and columns go into compression. Half the filament skin goes into compression, the other half into tension. This keeps the rods from shifting or detaching from the core.

Use the beam as a vertical column with the load on top, and the column reacts much like a piling sunk deep into the ground. The piling—surrounded by earth—has nowhere to deflect, and it can support tremendous weights. In much the same way, the captive column—surrounded by its filament skin—can't deflect either.

The reason for the opposing angles of the filament courses becomes apparent when the column is twisted. One course goes into tension to fight torque in one direction, the second takes care of torque in the other direction.

Of course, in a world of construction based on rectangles, the future of triangular beams is limited. But that's no problem—a captive column needn't be triangular. Use four triangular core elements, and you get a rectangular beam—just as strong as the triangular form.

Only two working examples. The captive-column concept is so new that that's all there are in use. Both are multihull sailboats. The first—a 20-foot catamaran—weighs 450 pounds. This is about 300 pounds lighter than conventional cats of this size. But the builder claims he overbuilt the boat. He figures it could be cut down to about 250 pounds and still remain structurally sound.

The second working example is a small trimaran. Its main hull, the two outer hulls, and the one connecting beam are all triangular captive columns. Like the cat, this prototype was overbuilt, but future models should weigh in at around 50 pounds ready to sail.

The future. High strength and low weight make the captive column a natural for the aircraft industry. The first real test in this area is a captive-column sailplane now under construction.

On the drawing boards are plans for a new superlight offshore powerboat. Engineers are studying captive columns for use in buildings ranging from skyscrapers to residential homes. Other applications might include bridges, radio and TV antenna towers, and helicopters. The list is endless.

Right now Lawrence Bosch's invention is so new its real place in the world is still uncertain. But my guess is that a lot of the liberated designs of tomorrow will be based on the captive column.

PS

Look and Listen

News, comment, and opinion
from the world of home-
entertainment electronics

By C. P. GILMORE

The computer tuner

A few weeks ago the Heath Company invited me to have a look at an amazing new digital FM tuner that will be on the market in a couple of months. There's no tuning knob; you get your station in one of three ways:

- *Punch the frequency into a 10-digit keyboard.* If you want a station at 96.3, just hit in order 9, 6, and 3.

- *Automatic scan.* Touch a button and the tuner automatically scans the FM band. When it finds a station, it stops. Touch the button again and it jumps to the next station. You can set threshold controls so it will pass up weak stations, or stop only at stations broadcasting in stereo.

- *Computer card memory.* Shove three cards punched for three specific stations into three card-reading slots. When you push button A, the tuner tunes to station A, and so on. You can put in new cards as often as you like.

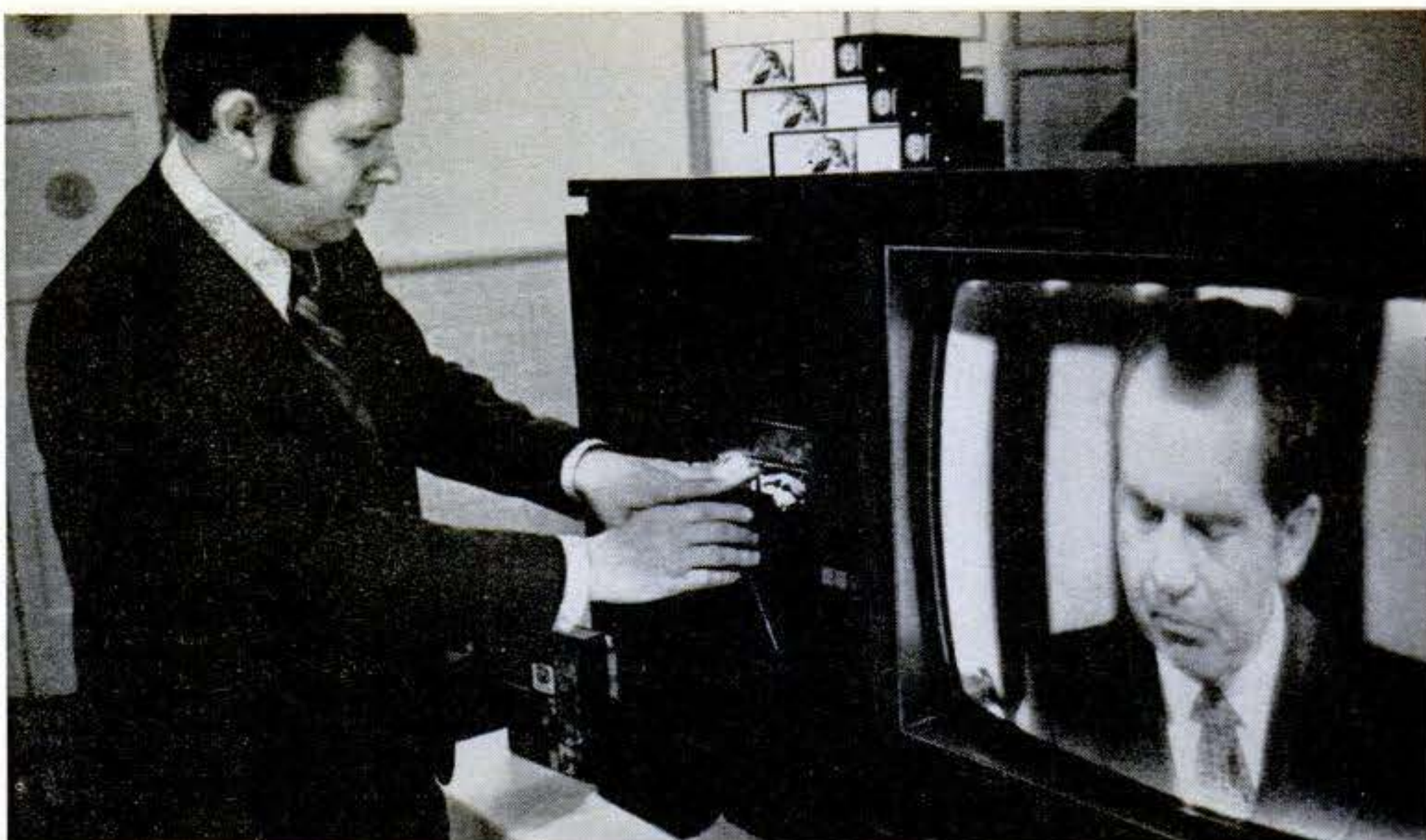
The whole tuner is full of integrated circuits and logic chips, plug-in-circuit



boards, and other parts common in computer technology. There is no dial; frequency is read out on four bright green Numitron digital displays. A front-panel meter indicates either signal strength or multipath.

Performance is spectacular, too. Sensitivity is better than 1.8 microvolts, selectivity and image rejection better than 95 db. Because digital circuitry requires little adjustment, there are just three simple, no-instrument adjustments called for to put the whole thing in perfect shape after construction.

Altogether, this is probably the most advanced tuner on the market. The price is advanced, too: The AJ-1510 tuner kit will cost \$540; the optional pecan cabinet, \$25. We'll have a kit report as soon as units are available.



Finally: cartridge TV you can buy

Sears has made it official: Beginning in June, Sears stores in the Chicago area will begin selling cartridge-TV record-and-playback units for home use. After years of talk by many companies, this will be the first time that a unit meant for the general public actually appears on the market.

Sears will use the widely publicized Cartrivision unit made by Cartridge Television, a division of Avco. Sears' console model will contain a record/playback deck, a black-and-white camera, and a 25-inch color-TV set. Price on this top-of-the-line model will be about \$1,600. Sometime in 1973, Sears will offer a playback unit for use with your own color TV. It should sell for about \$750.

Sears will also make available for rental some 600 recorded tapes of movies, sporting events, self-help programs, and other types of material. Rental on a movie will be \$3 to \$5—for one play only. Blank tape for making your own video movies will sell for \$13 to \$40 a tape depending on length—up to about two hours.

I found the unit easy to use. As shown above, just shove in the book-sized cartridge, close the door, and push a button. If the picture is fuzzy, touch up a tune control. Picture quality is not as good as live TV, but it is acceptable.

The battle between the competing video playback systems, of course, isn't over. In fact, this is just the opening gun, and over the next few years we're likely to see other, noncompatible systems introduced for home use. But the Cartrivision system, first on the market with the help of Sears, obviously has a tremendous head start.

The sound gets better

The trend to higher-quality tape continues. Norelco, the company that started the whole cassette thing, is bringing out a new line of chromium dioxide tape. So is TDK. TDK will also soon introduce the C-180 cassette (playing 90 minutes on each side) that I mentioned in the December column, and an even higher-performance version of the company's already excellent Super Dynamic high-density iron oxide tape. A steady improvement in tape, plus a similar advance in record and playback equipment, has made the formerly lo-fi cassette almost the equal of the phonograph record, and progress continues.

End of an era

The name Ampex is almost synonymous with the term tape recording. The firm produced the first widely used professional audio tape recorders for broadcast use two decades ago, and played a dominant role in establishing video-tape recording as an everyday tool around the TV networks and broadcast stations.

A few years ago Ampex decided to get into the consumer-audio business, and put out a line of tape recorders for home use. Now, says Ampex, its adventure in the consumer market was a mistake. After a whopping \$40 million loss last year, Ampex is scrapping its consumer-audio division. But the company says it

may keep selling a few top-of-the-line units just to keep its foot in the door if it ever changes its mind again.

Think small

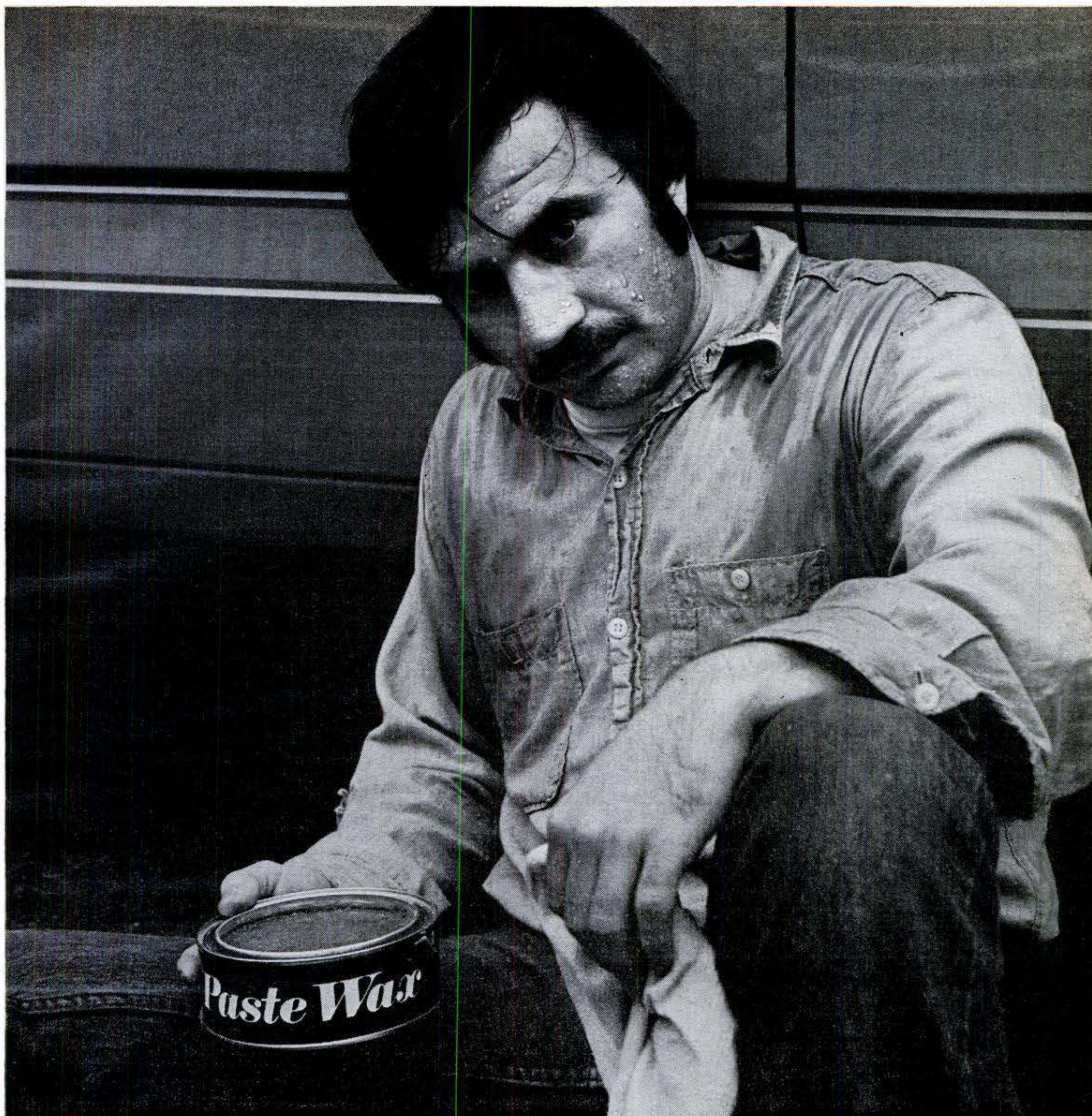
A couple of years ago, you may remember, Panasonic introduced a 1½-inch black-and-white TV set, thus winning the unqualified worldwide mini-TV sweepstakes. Now they've done it in color. The model GT-551 (below) has a 4½-inch screen measured diagonally. It weighs 18 pounds and will run two hours before the batteries need recharging.

I borrowed the first set to reach the



New York area and amazed other passengers on my commuter train that night when I took off the cover and began watching color TV as we sped along the shores of the Hudson River. The picture

Continued
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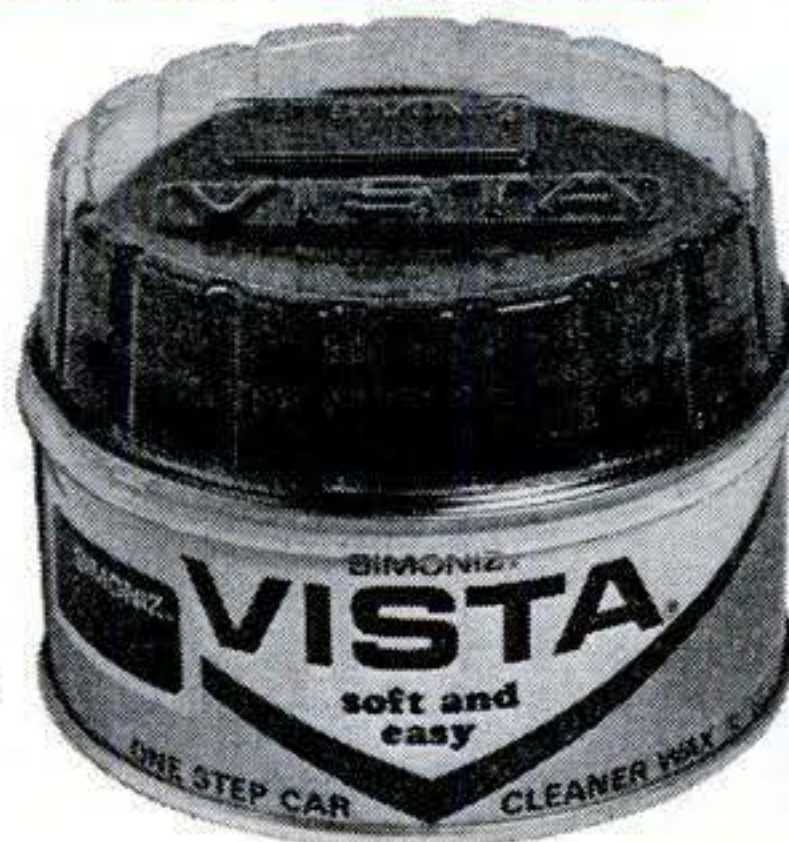
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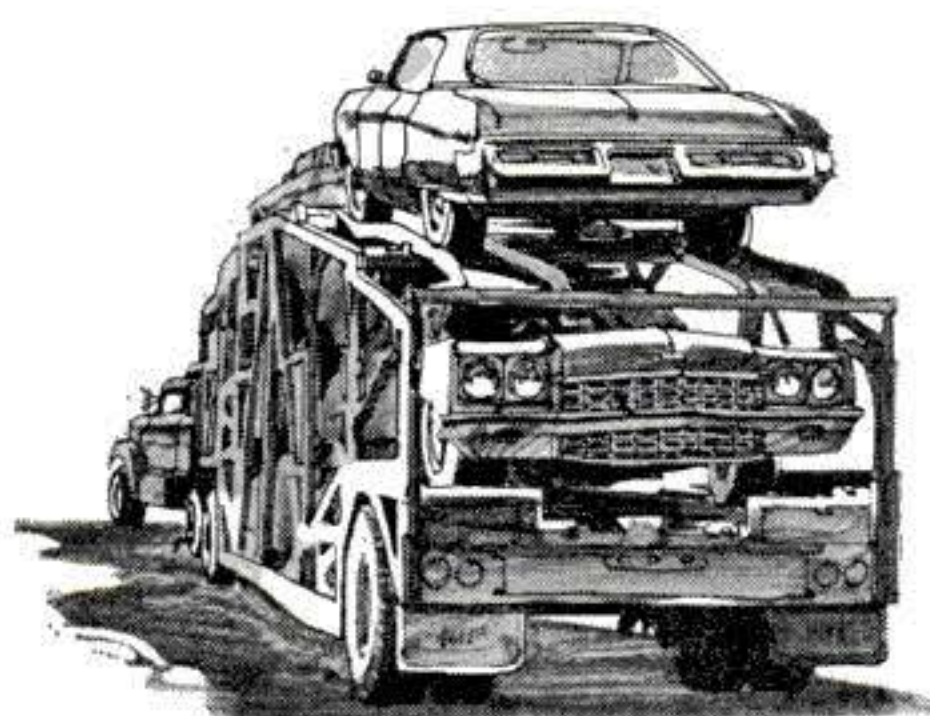
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Look and Listen

[Continued]

flipped occasionally with changes in signal strength, but overall picture quality and reception were excellent.

Miniaturization doesn't come cheap: The 551 costs \$430. If you can put up with a slightly larger picture, Panasonic is also making a seven-inch set for \$399, and a nine-inch for \$299.

Colorful new developments

Sony's Trinitron color picture tube, with its vertical color stripes, offers several advantages over the conventional shadow-mask tube, which uses clusters of colored dots to produce color images. For example, the picture is brighter and the set needs no convergence to keep the image crisp. But it has disadvantages, too: The front screen is cylindrical rather than spherical, which makes it expensive to manufacture.

Now Toshiba has announced a tube that combines the advantages of the Sony tube with the spherical tube face. It uses a brick-like pattern of rectangular phosphor patches. The picture is reportedly as bright as the Trinitron, but the price should be lower—about the same as the shadow-mask tube. And since the new tube doesn't need convergence circuitry, the overall price of the set should be lower. The new tube is first scheduled to appear in a nine-inch set made by Sharp, but can be made in any size.

There's a lot brewing in the TV-tube business, with the new Toshiba entry and the Uniray tube [PS, Feb.]. And it looks as though the day of the shadow-mask tube—which brought in the age of color TV—may be nearing its end.

The communications revolution

With the coming of the age of TV a couple of decades ago, a new business that almost nobody noticed at the time sprang into being. Today, that once-obscure business promises to drastically change our customs and life styles.

It all began because some towns were behind mountains or out of range of the nearest TV station. So enterprising operators installed antennas on towers or atop hills, to bring in distant stations. Then they wired an amplified signal directly into homes for a few dollars a month. Cable TV was born.

Some operators got the idea of improving business by offering subscribers an even greater variety of programs by bringing in signals from even more distant stations by cable and by running their own movies and other programs.

The number of TV channels in any area is limited because there is a shortage of space in the broadcast spectrum. So broadcasters have enjoyed a semi-monopoly, insulated to some extent from the rigors of competition. Naturally, they saw the whole cable development as opening the door to a vast army of competitors. And they don't like it.

The FCC decided some time ago to inject itself into the growing battle between broadcasters and the cable industry, and now after a lot of hassling has issued a set of rules. Essentially, they provide

that cablecasters can bring in up to two additional channels from beyond normal reception range. In the country's 50 biggest TV markets, broadcasters will be able to buy exclusive rights to movies and network reruns and keep them away from cablecasters. In the next 50 markets, the broadcasters' exclusive rights expire after a year. Everywhere else, it's every man for himself.

In this compromise, the broadcaster has given a little, and as a result people in some cities will have a wider choice of programs to watch. But there's a deeper significance: The slight retreat on the part of the broadcasters is the first move in what I think will ultimately become rout. I believe cable is the wave of the future, because it can pipe a virtually unlimited number of channels into our homes. This means not just more network-type TV, but more specialized programming from Broadway plays to how to build a sailboat. In addition, we've already got the technology to make cable TV two-way. With such a system you could visit the library, do your banking or use a time-sharing computer—not to mention watching Marcus Welby—without ever leaving your home. Prototype systems of this type are already being tested in several communities.

The cable revolution, abetted by the enormous information-carrying power of communications satellites, is going to change the way we live, do business, and pursue our leisure pleasures. And it will do it in your lifetime and mine.

Record review by Ken Furie

Some records are cheap. Others produce great sound quality. Yet others are first-rate musically.

Once in a while a record or series of records combines all of these qualities. When it does—and when the music recorded is top-drawer but previously neglected, then you've got a major event in the record world.

That's just what is happening on the London Stereo Treasury label as Anta Dorati and the Philharmonia Hungarica have begun recording all 107 of Haydn's symphonies.

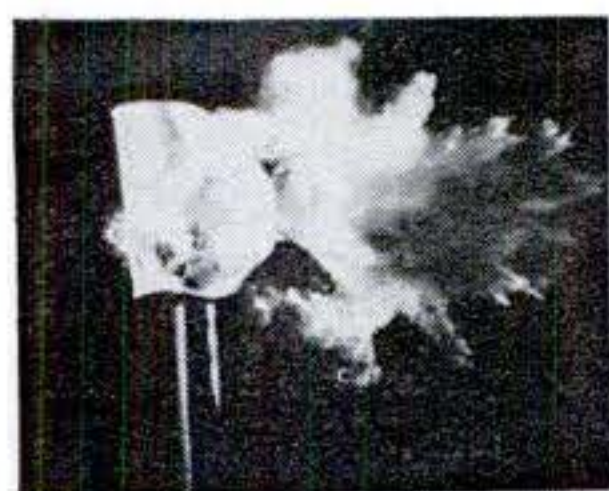
Of course, a dozen or so of Haydn's symphonies have always been popular. The rest have won increasing attention in the 20 years of the LP discs. All have been recorded at one time or another but usually by small companies and frequently inadequately.

In this new series, Dorati's Haydn playing is as fine as any I've heard; the sound quality is spectacular. Best of all, each four-disc set (containing eight symphonies) lists for a ridiculously low \$12. And each contains brilliant notes by the Haydn scholar H. C. Robbins Landon.

Released to date are *Symphonies Nos. 49-56* (STS 15127/30), *Nos. 57-64* (15131/4), and *Nos. 65-72* (15135/8). There isn't an ordinary movement in these 24 symphonies; all reveal an astonishing blend of wit, grace, passion and sanity. If you'd like to try one box set, *Nos. 49-56* offer the most variety.

Winchester and Western extra-power 22s have all the flat-shooting, power-packed, high-velocity performance you'd expect from any ammunition marked Super-X.

Each offers the utmost you can get from a 22 Short, Long, or Long Rifle, in the original brand of long-range power that's never been topped.



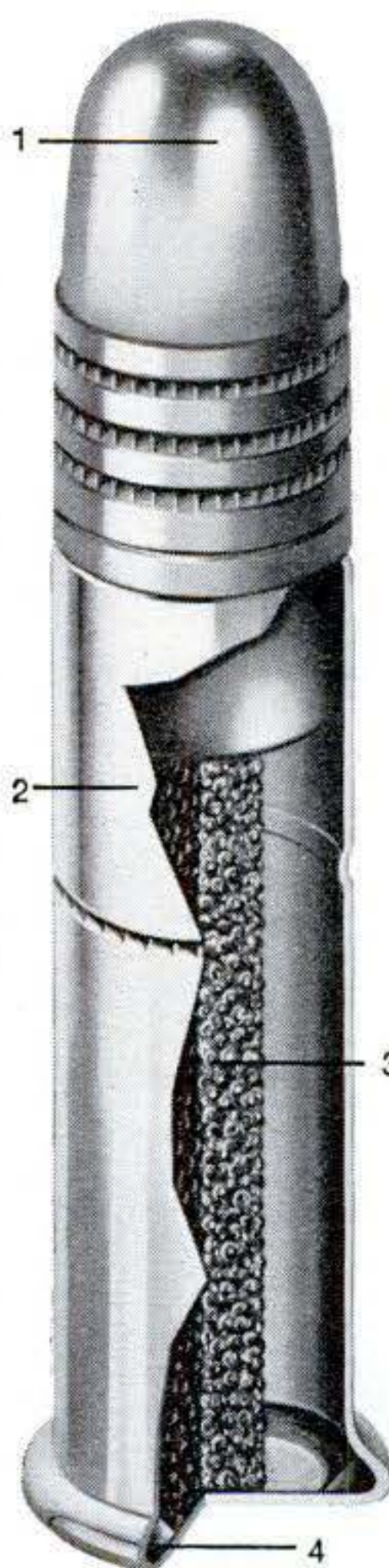
Super-X . . . the name that means "extra power" now in both Winchester and

Western brands. For years hunters who require the most powerful ammunition have relied on Super-X to bring down big game, or high flying waterfowl. This same kind of reliable Super-X extra power goes into our high velocity Super-X 22s too, to give you a cartridge that hits with impressive power for a 22 rim fire . . . perfect for small game, pests or varmint hunting.

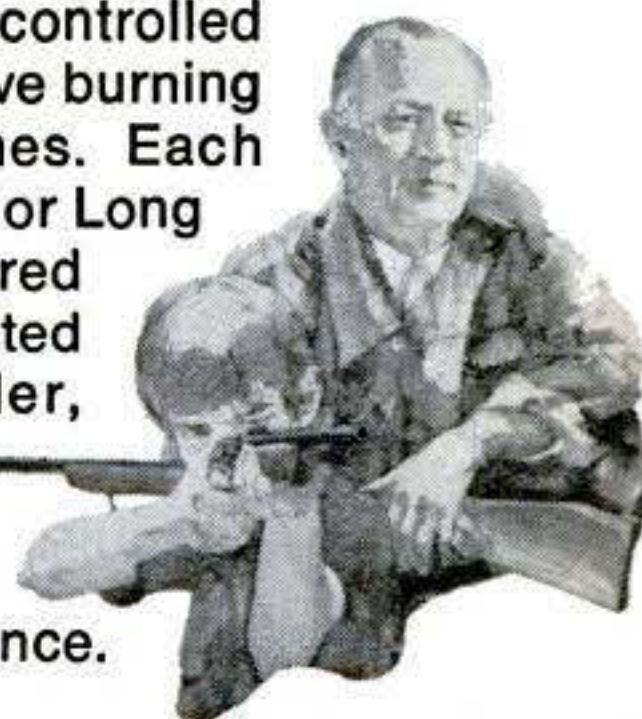
1. Exacting bullet weight and contour. To ensure all the long-range, wind-bucking accuracy you need, to go along with extra power, Super-X bullets are made to exacting standards of weight and contour, so they'll hit where you're holding for elusive rabbits or wary squirrels. Bullets are available in Short, Long, Long Rifle, Lubaloy or Kopperklad coated for better performance. Hollow points, too, in Short and Long Rifle.



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Ask for the new
High Strength Plastic 100 pack

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Rating the

In tests by two of Europe's leading motor magazines, steel-belted

1969: Auto Motor und Sport Magazine

1 ST	Uniroyal 180	(Steel)
2 ND	Michelin XAS	(Steel)
3 RD	Phoenix Sen.	(Fabric)
4 TH	Metzeler Monza	(Fabric)
5 TH	Fulda P 23	(Fabric)

1970: Auto Motor und Sport Magazine

1 ST	Uniroyal 180	(Steel)
2 ND	Pirelli CN 36	(Steel)
3 RD	Michelin zX	(Steel)
4 TH	Kleber V 10	(Fabric)
5 TH	Semperit	(Fabric)
6 TH	Dunlop SP 68	(Fabric)

These tests included: handling on curves, steering exactness on a zig-zag slalom course, braking distance and behavior, acceleration and skid resistance on a wet circular track, comfort and wear. In addition, Auto Motor und

Sport included a test for tire noise in '69, winter suit-

Although radial tires are big news in the U.S. today, they have been widely used in Europe—and increasingly preferred—for the past fifteen years.

To a European motorist, the question today is not whether to get a radial, but what kind of a radial to get.

To help answer that question, two of Europe's leading motoring magazines—"Auto Motor und Sport" and "Auto Zeitung"—conducted exhaustive track tests of the most famous European radial tires. (Test criteria are described above.)

The results show that steel-belted radials as a group received higher overall ratings than fabric-belted radials, winning both first and second places

in 1969, 1970 and 1971. They did not, of course, win in every test category.

The steel-belted radial tires have a built-in advantage which was not included in these tests—substantially greater protection against cuts and punctures—because the belts under the tread are made of steel wire. (Cuts are the major cause of tire failure, by the way.)

**Uniroyal steel-belted radials
are now available in the United States.**

We are pleased to be able to tell you that the Uniroyal 180 steel-belted radial—which won first place



e radials.

ial tires received higher overall ratings than fabric-belted radials.

1971: Auto Motor und Sport Magazine

1 ST	Metzeler Monza (Steel)
2 ND	Conti TS 771 (Steel)
3 RD	Uniroyal 180 (Steel)
4 TH	Phoenix Sen. (Fabric)
5 TH	Fulda P 25 Rib (Fabric)
6 TH	Goodyear G800 (Fabric)

ability in '70 and aquaplaning tendency in '71.

overall in three out of four of the above series of tests—is now available in this country in sizes to fit most of the popular European cars.

In addition, Uniroyal is now making a steel-belted radial especially designed for American cars, called the Uniroyal Zeta 40M. This tire is being produced in the United States.

Other companies are beginning to offer you steel-belted radials. But bear in mind that the steel-belted radial is a more difficult tire to make because steel is a more difficult material to work with.

Uniroyal has made more than 20 million steel-belted radials over the past 12 years, and knows how to make them properly.

In fact, there are only two tire companies in the world that have this much experience in making steel-belted radials—Michelin and Uniroyal.

When you go to buy a steel-belted radial, don't let them sell you just a radial tire or a steel-belted tire. It's not the same thing.

Here is how to tell what you're getting. If the dealer tells you it's a "radial tire", you can be pretty sure it's a fabric-belted radial. If he tells you it's a "steel tire," the chances are it's a steel-belted bias construction. (That is, a conventional tire, without the performance advantages of a radial.) If it's a steel-

1971: Auto Zeitung Magazine

1 ST	Uniroyal 180 (Steel)
2 ND	Michelin zX (Steel)
3 RD	Pirelli CF 67 (Fabric)
4 TH	Conti TS 771 (Steel)
5 TH	Kleber V 10 (Fabric)
6 TH	Conti TT 714 (Fabric)
6 TH	Fulda P 25 Rib (Fabric)
8 TH	Dunlop Sp 57F (Fabric)
9 TH	Phoenix P110Ti (Fabric)
10 TH	Bridgestone (Fabric)
10 TH	Metzeler Monza (Steel)
12 TH	Metzeler Monza (Fabric)
13 TH	Goodyear G800 (Fabric)

belted radial, you can bet your boots he's going to let you know it!

Would you like to know the name of a dealer in your locality where you can get Uniroyal steel-belted radials? Telephone (800)-243-6000 anytime, free of charge. In Connecticut, call 1-(800)-882-6500.

Would you like to get a complete and unabridged English translation of the reports of all four of the radial tire tests described above? Send 25c to Dept. GP, Uniroyal, Oxford, Connecticut 06749. When you're finished reading this series of test reports, you'll know what to look for in radial tires.





The View Down the Road

...news and comment on cars and driving

By JAN P. NORBYE / PS Automotive Editor

The fuel fight gets hotter

GM president Ed Cole has asked the oil companies to develop a new high-volatility gasoline. Such "light" fuel will burn cleaner in a cold engine, but has reduced energy.

Why does GM want it? Because '73-model emission controls must pass a cold-starting test, and the planned equipment needs time to warm up to work at full capacity. A change in fuel would be a shortcut to meeting the standards, and avoid developing new exhaust systems, or replacing the carburetor with fuel injection.

Instead, the petroleum refiners face a new problem: rebuilding many facilities, including entire refineries, and installing new equipment all along the line. They also point out that use of high-volatility fuel is a waste of natural resources.

As the fuel fight gets hotter, the onus may be shifted away from both the engine and the gasoline and onto the test cycle. Perhaps the government will have to modify its requirements for low emissions during start-up from cold.

Lead to go? Lead to stay?

Another installment in the long dialogue between Ed Cole and the oil companies began in January '70 when the GM president requested lead-free gasoline, and announced a month later that '71-model GM cars would be built to run on unleaded fuel.

What's happened? Most brands now offer "low-lead" gasoline, but there are no more truly lead-free ones than before. And the leaded fuels are still there. California has set '74 emission standards that will be difficult to meet with leaded gas, and the Environmental Protection Agency has a plan that would require gas stations to offer lead-free gasoline by mid-'74. It seemed we were moving, step by step, toward getting the lead out.

Then in January the federal government announced that all emission tests for certification of '74 models must be conducted with leaded gasoline! Now the dialogue is no longer a dialogue. Ford jumped in and said the government had now clobbered its program to meet the '74 California standards. Because Ford was planning to use catalytic converters using platinum catalysts, and lead will just destroy these catalysts.

From where I'm sitting it looks like federal legislation is getting in

the way of the federal government's best intentions. The EPA plan, which can in no way prohibit the use of lead, would promote the use of lead-free fuels, so that by 1977, total lead emissions would be reduced by 60 percent. The auto industry seems willing, even anxious, to support this trend. But the oil lobby must have persuaded Washington that it's undesirable.

Wait for the finals

The foregoing must be viewed as a small triumph for the oil companies. They make more money on leaded high-octane gas (replete with other additives) than on regular or unleaded fuel. But what about the long run?

The fuel fight going on is being fought over the body of the piston engine. That engine won't be replaced quickly—not in '74, not in '76. But it will be replaced, gradually, beginning in '74. With the Wankel engine. And there, my friends, we go into what I call the finale.

The Wankel engine doesn't need lead or any other additives. It's totally uncritical of octanes. Tests by Toyo Kogyo have shown that the Mazda engine tolerates gasoline down to 68 octane with no loss of performance or economy. Current low-lead fuels are rated at 91 (Research). With a general switch to Wankel engines, the demand for octanes will slowly disappear.

But let's look further ahead, to the gas turbine. And we all know what that burns. Kerosene, jet fuel, and other low-grade petroleum products. If that's the way we're going, that makes the current fuel fight quite redundant, doesn't it? But there are lots of people in the oil companies who don't think it's going to happen, who think the good ole days will go on forever; that the Wankel engine and the gas turbine will pack up and go away. Now it's your turn. Just watch the future become reality.

Where do old tires go?

Today more than two billion scrap tires litter the landscape of America. And 200 million more are scrapped every year. Less than 10 percent are reclaimed. These facts should disturb you. But I've got good news.

There's a big future in junked tires. Not for bumpers or such. On the highway. Literally. Adding reclaimed rubber to the "hot-mix" asphalt is not expensive (12 to 15 percent of hot-mix cost). It pays off

in several ways: adds to the surface life, cuts down road maintenance, lessens roadway bleeding, and avoids rough edges. The surface will neutralize oil deposits to some extent, and is less sensitive to temperature changes than common asphalt. The rubber will also prevent the formation of ruts and ridges.

To prove it all: Genesee Street in Buffalo, N.Y., hasn't been resurfaced since 1925, when it was done with rubber in the hot mix. The process, developed by the U.S. Rubber Reclaiming Co., is known as Ramflex. I'd like to see a lot more of it.

Hope for the Saturday mechanic

Wouldn't you love to work on your own car, if you only knew for sure you could do it right? As if you had an expert looking over your shoulder? Well, the day has come, if you live in Madison Heights, Mich., where the first of a chain of U-Tune facilities has opened. The center provides the newest test equipment, right down to emission analyzers, and trained technicians are on hand to give advice on know-how and tools. This automotive self-service shop enables the car owner to do his own tune-ups, general electrical repairs, and light-servicing and maintenance, for a small fee.

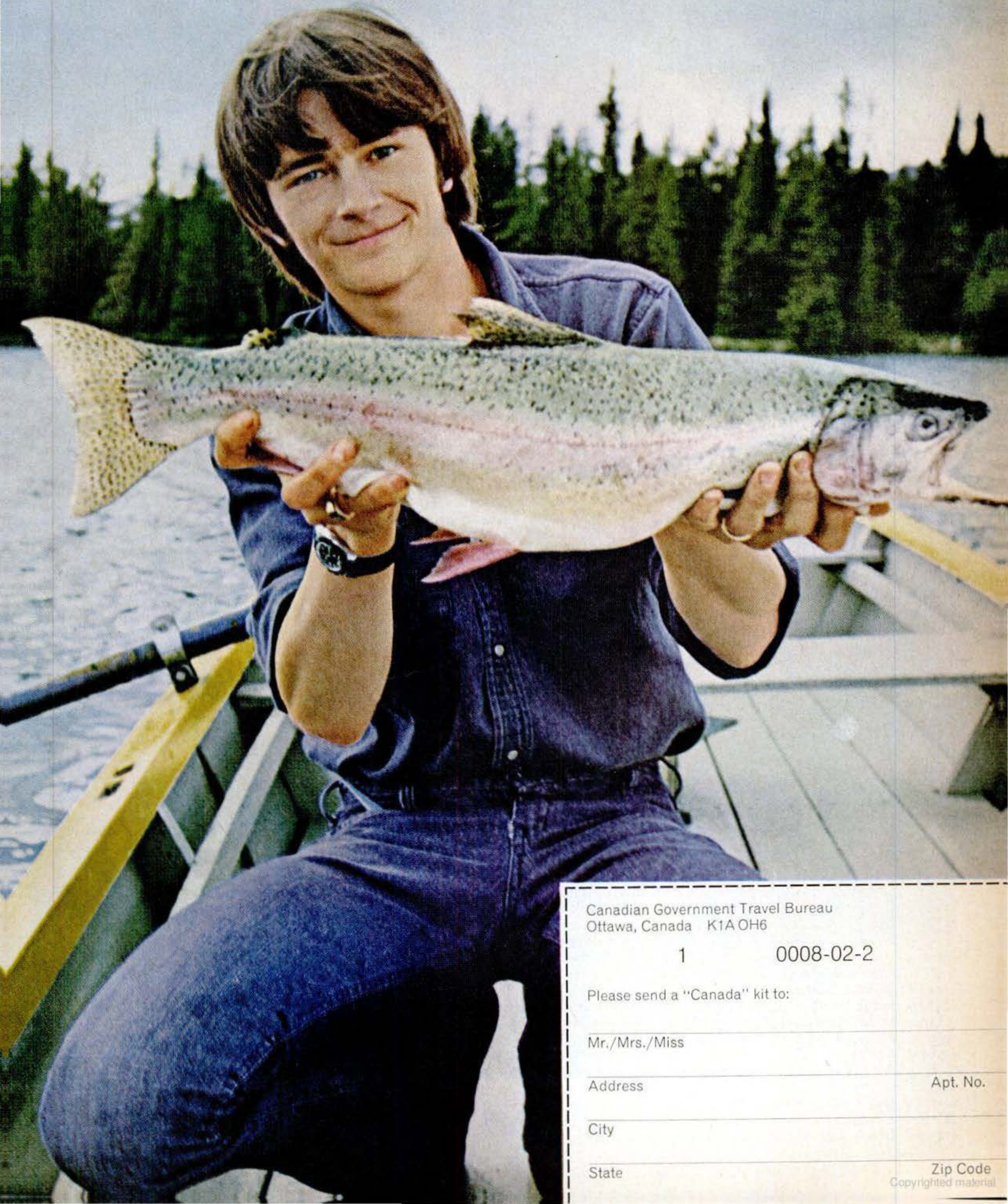
The plans call for a rapid spread throughout Michigan, then on into other states. I would like to see a nationwide network of do-it-yourself service stations staffed by competent personnel. Perhaps this is one way we can lick the auto-repair crisis we're in.

A case of the uglies

Safety cars represent a giant step backward in body design when compared with the passenger cars now on the road. At least that was the reaction when AMF and Fairchild unveiled their safety cars that were designed as prototypes of safe automobiles of the '80s. With the extended bumpers, asymmetrical body lines, and lack of unity, they appear more like also-rans in a kids' model-car contest than the \$100,000 machines the government is paying for. GM took note of this last winter when it announced that its safety car, being built for the government at a cost of \$1, will be highly styled as well as functionally safe. With models like the AMF and Fairchild, no wonder the public is apathetic about safety cars! Does the auto industry do the better job, after all? Could be. PS

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Science Newsfront

Last-minute news
and notes to keep you
up-to-date

By ARTHUR FISHER

Drinking-man's guide

There's terrible news for bourbon and brandy drinkers, whose worst suspicions are now confirmed. If, as many researchers believe, hangovers are caused primarily by the congeners in alcoholic beverages, then straight bourbon and cognac are the worst offenders.

Physicians at the New Jersey Neuropsychiatric Institute and the Center of Alcohol Studies at Rutgers measured the content of congeners—which include such chemicals as wood alcohol and acetaldehyde—in seven beverages. The results, in milligrams per 100 milliliters:

Vodka	2.65
Gin	3.91
Canadian	40.16
Scotch	95.00
Bourbon blend	111.4
Cognac	212.3
Bourbon	245.5

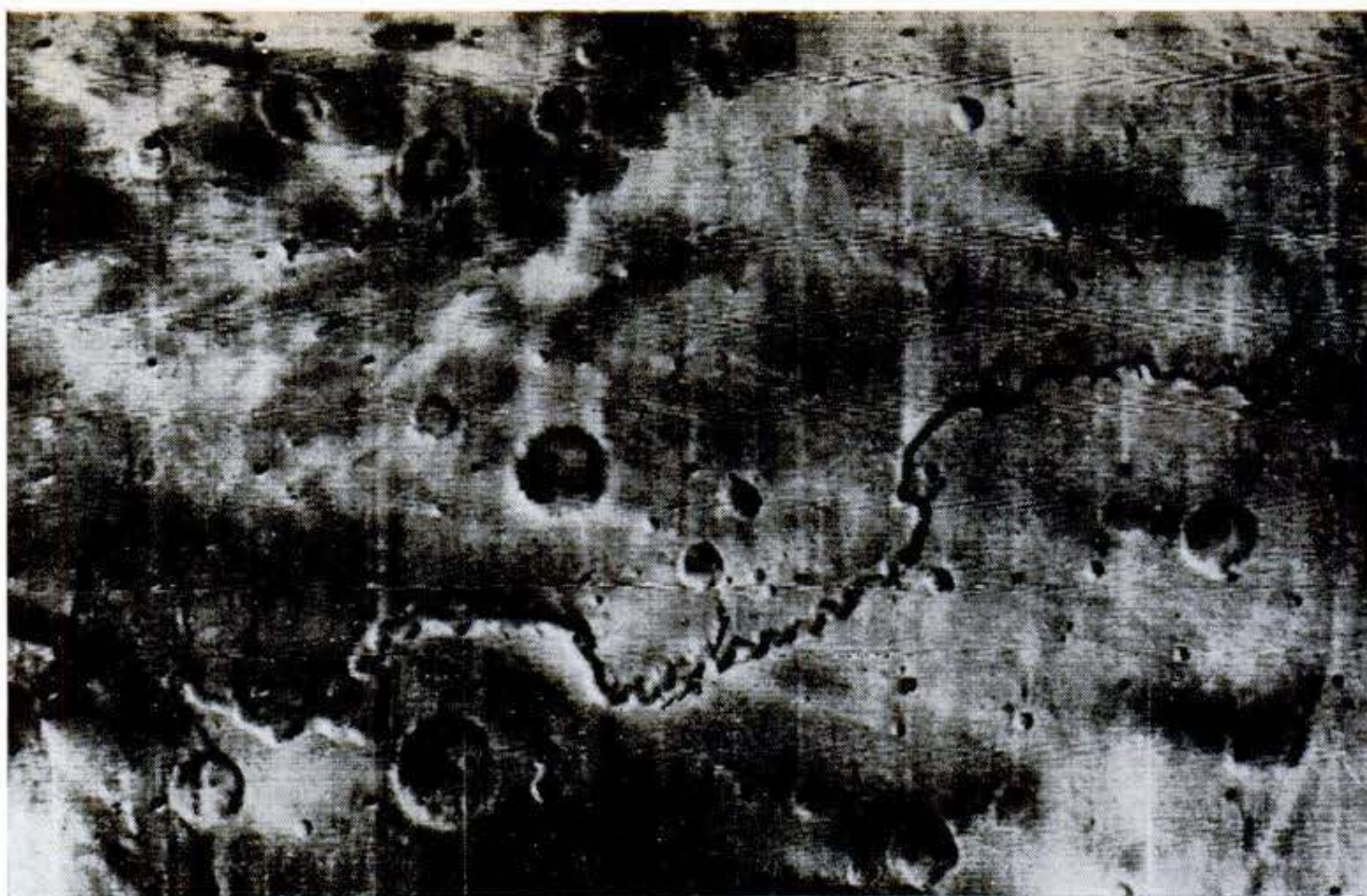
Now we know why Martini drinkers always look so damn smug.

First turbine autogyro

What you're looking at is actually a convertible jet-aircraft ejection seat, with deployable rotor, engine, and controls, all of which unfold automatically



into a powered autogyro. It's the SAVER (Stowable Aircrew Vehicle Escape Rotoseat). Like the Ballute [p. 71], its function is to allow pilots of disabled jet planes to eject and then fly off to safe territory. Under development for several years by Kaman Aerospace Corp., SAVER flew this winter for the first time, incidentally becoming the world's first turbine-powered autogyro. It uses a Williams Research turbofan engine. In practice, the seat would open



Mariner 9 snaps a giant "arroyo" on Mars

This surprising photograph of Mars, taken by the orbiting spacecraft Mariner 9 from a distance of 1,033 miles, shows a huge valley, some 250 miles long and three miles wide. It resembles an Earthly arroyo—a watercut gully common to the Southwest U.S.; but scientists believe it may have been produced by Martian lava flows.

and fly automatically. Even if the pilot were unconscious, it would follow a radio beacon to a safe area, where the pilot would be separated from the seat and descend by parachute.

Unexpected cadmium

In two developments separated by thousands of miles, researchers have discovered the unexpected—and unwelcome—presence of cadmium in lead-free gasoline and in plastic products. The metal is poisonous to humans in large enough amounts, and is one of the heavy metals—along with lead, mercury, and others—that are of increasing concern to environmental health scientists.

Engineers at Louisiana State University discovered what they deem a significant amount of cadmium—50 parts per million—in a popular unleaded gasoline (and not in leaded gasolines). They first detected a cadmium compound in auto emissions, and then analyzed the gas itself.

And in Sweden, scientists of the National Environment Protection Board discovered that many toys and such household articles as drinking straws—all made of PVC plastic—contained an "alarming" quantity of cadmium. They are concerned that children who habitually suck such items may be ingesting enough cadmium over a long period to cause organic damage.

Although cadmium and its compounds are known to be toxic to people and animals, the exact nature of its biological action is unknown. It can cause lung, kidney, and intestinal disorders.

Improved ferro-cement

The Navy has found a way to increase both the strength and durability of ferro-cement structures, which have been plagued by tiny hydrogen gas bubbles that form in the fresh cement mortar.

About two ounces of chromium trioxide—a dollar's worth—added to every 50 gallons of cement-mix water will stop the gas from forming.

Room for the radar autos

This strange room is an anechoic, or echoless chamber—a very special one. This one sops up, not sound waves, but microwaves—radio-frequency (RF) energy—in unwanted bands. It's lined with carbon-latex-impregnated polyurethane foam, which converts all such energy to heat. The purpose is to provide a test ground for the GM Research Laboratories' experimental radar-sensing system for automobiles.

That system, as GM conceives it, would use a radar detector built into the front end of your car. It would keep



track of the gap between you and the car ahead, set off a buzzer or light if you got too close, and even actuate an air bag if a crash were imminent.

A large photograph of a cowboy in a red shirt and cowboy hat herding a group of horses in a green field. The horses are of various colors, including brown, white, and black. The cowboy is in the foreground, looking towards the horses. The background shows more horses and a distant horizon.

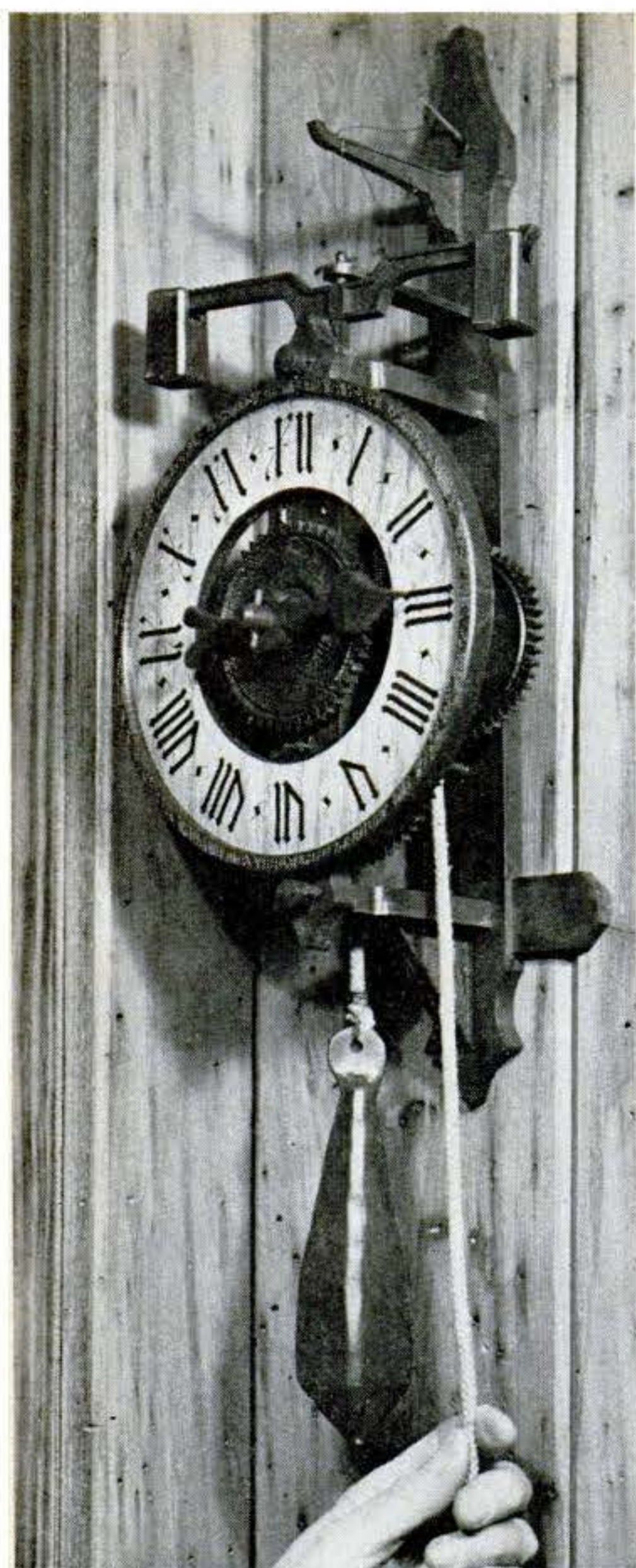
Come to where the flavor is. Come to Marlboro Country.



Marlboro Red
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you get a lot to like.

Warning: The Surgeon General Has
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Is Dangerous to Your Health

Kings: 20 mg. "tar," 1.3 mg. nicotine—100's: 22 mg. "tar," 1.5 mg. nicotine av. per cigarette, FTC Report Aug. '71



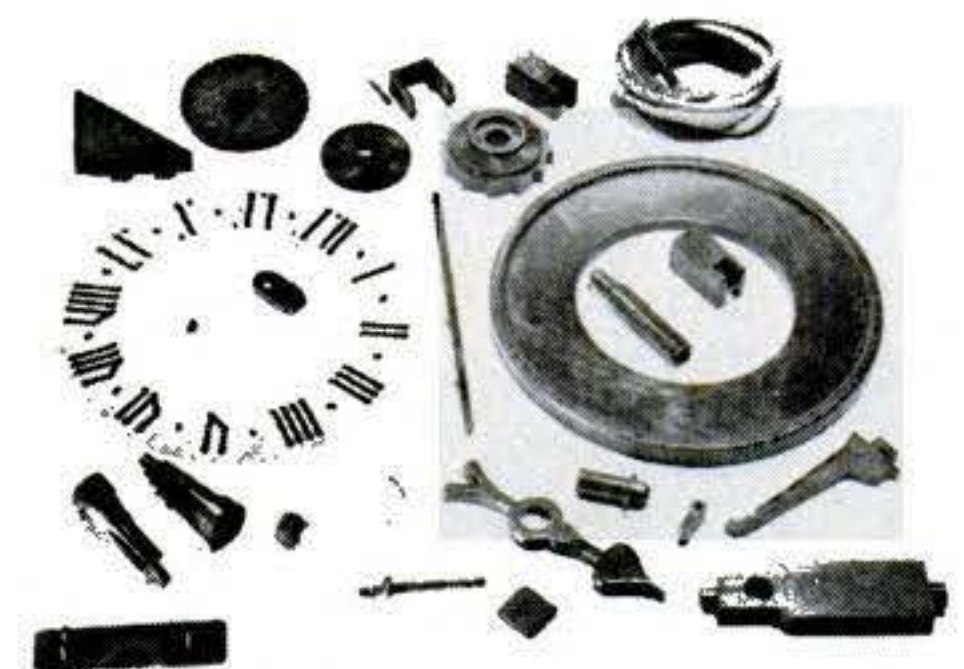
Unique timepiece is powered by a hollow plastic weight filled with nails or lead.

Clock Kit You Assemble with One Hand

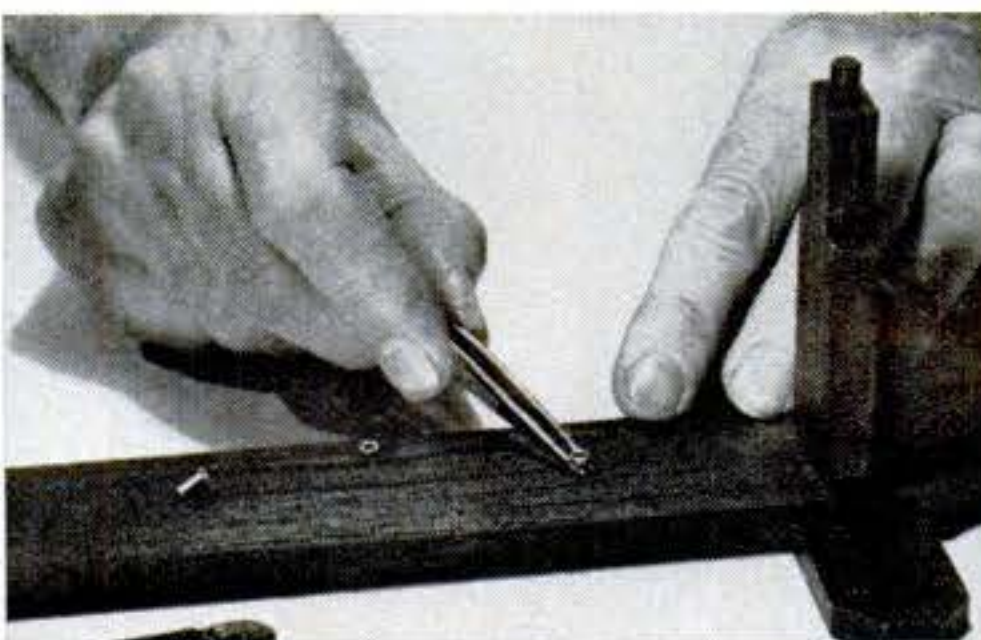
Want to set the clock back 700 years? Assemble this 13th-century timepiece. It comes in kit form. For about five bucks you get an assortment of metal pins, bearings, springs, and hooks, plus about 36 wood-simulating plastic parts—but only one hand. Seven hundred years ago, folks were happy just to know the approximate time, so this clock has no minute hand.

Assembly is easy. The instructions are detailed, and most of the parts just snap together and lock in place without glue.

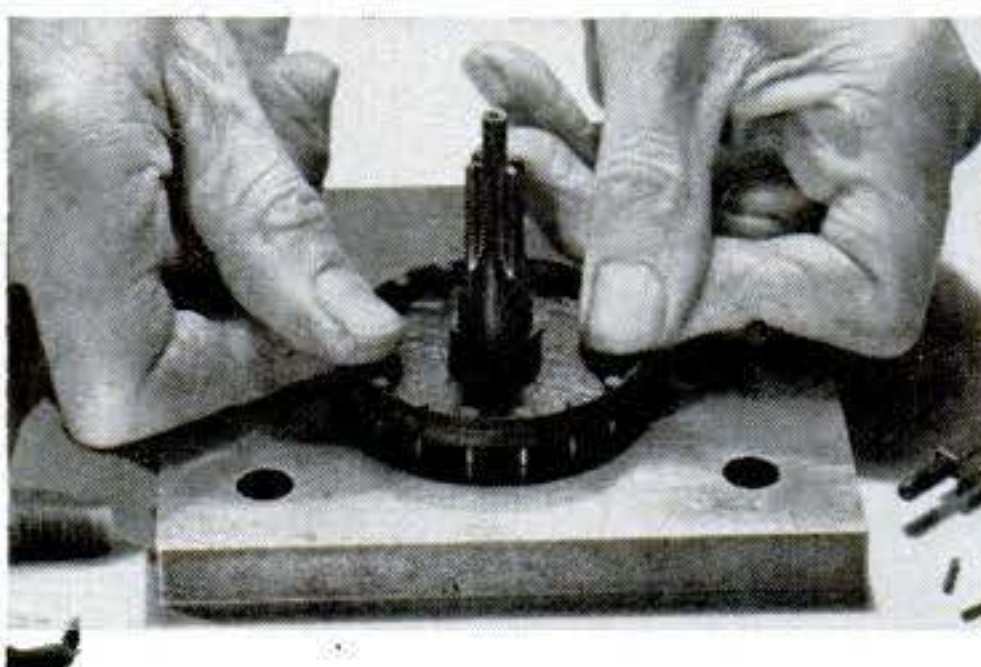
The clock is Lindberg Line kit number 327:500. You can get it by mail from Caldwell Industries, Box 170, Luling, Tex. 78648. Price (with postage) is \$5.50.—Walter Burton



What you see is what you get in the kit. Author found the plastic parts accurately molded, the entire kit well engineered.



Metal bushings pressed into the plastic clock parts serve as bearings for rotating gears, which are mounted on metal shafts.



Assembly of crown gear is one critical construction step. Seventeen metal pins must be installed, each with same projection.



Clock's works are exposed, and fascinating to watch. The wag-bar escapement can be adjusted to give accurate performance.

Science Newsfront

[Continued]

Hoist by their own petard

During a severe storm last winter that hit the entire Northeast (and during which, incidentally, a wind gust atop Mount Washington in New Hampshire hit 166 mph, highest in 11 years), a group of eminent meteorologists meeting in Oswego, N.Y. were marooned by a mighty blizzard. The subject of their conference: snow and snowfall modification. It's not nice to fool Mother Nature.

Changeable clothing

How would you like to own a suit that's both a tropical and a heavyweight? It isn't here yet, but textile scientists have made a step in the right direction. J. P. Stevens & Co., Inc., has been awarded a patent for "temperature-adaptable fabrics," which automatically increase in thickness and heat retention as the temperature goes down, and become thinner and cooler when the mercury goes up. How? The textile contains inflatable elements, such as hollow filaments or pillow-shaped packets, which can retain both liquids and gases. In the Stevens process, the chemicals chosen are such that when liquid solvent freezes, it expels gas, which inflates the textile elements and increases the fabric's bulk and insulating qualities. When the temperature rises, the gas redissolves in the solvent, and the element shrinks.

Linking length and time

"A whole new era in measurement science." That's what the Commerce Department foresees as a result of a breakthrough scored by physicists at the National Bureau of Standards, who successfully achieved the highest frequency measurement ever.

They ticked off the frequency of the infrared light emitted by a helium-neon laser—88,376,245,000,000 cycles per second—100 times higher than any frequencies measured until four years ago. And because the wavelength of the infrared light is already known to a high degree of accuracy, a new and much more precise figure for the speed of light will result. (The speed of light—a constant—equals the wavelength multiplied by the frequency of any given electromagnetic radiation.)

The improvement should yield impressive dividends in fields as diverse as space science and astronomy, communications, and chemical analysis—all of which demand ever more precise measurement techniques.

Moreover, the new development opens the way toward achieving a long-sought goal of physics: an interchangeable "yardstick" for measuring both length and time. In the words of Dr. Lewis M. Branscomb, Director of the National Bureau of Standards: "To interchange clocks and rulers, scientists must know the speed with which light travels. . . . With this demonstration that both the space (wavelength) and time (frequency) dimensions of a single light source can be measured with prodigious accuracy, this goal is now within our grasp."

P.S.



If the job is big enough — give it to an Evinrude V-4.

An Evinrude V-4 is inherently strong, and rugged, and tough.

Power is *concentrated*. The crankshaft is only 15 inches long. Which keeps the motor *low* on the boat — increasing stability.

Power comes from *efficiency* — not just size. From re-cycling fuel that used to be drained overboard. From

reclaiming wasted exhaust energy. From sure-firing electronic ignition. From computer-selected lower unit shape and gearing.

Performance is distributed *all along* the power curve — to give you the best possible combination of low-end drive, mid-range acceleration, *and* all-out top-end speed.

Even the trolling performance is something special.

There are three compact Evinrude V-4 models — 85, 100, and 125 hp.

Never has so little done so much.

Full line catalog free. 16 Evinrudes — 2 to 125 hp. Write: Evinrude Motors, 4063 N. 27th St., Milwaukee, Wis. 53216.

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Div. of Outboard Marine Corp., makers of OMC Stern Drives



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Patterns on Paint with a Tool That Goes "Squish"

For eye-catching patterns like nothing you've ever seen, try this ingenious applicator on a coat of wet paint

By JACKSON HAND

This is the squisher

Mood Maker is Ward's name for paint applicator with soft, squeegee-like fins.



Here's how you use it

Just jab applicator against wet second coat. To clean, squish in a can of thinner.

Whatever you call it, the official name is "Mood" finish. It's a new idea from Montgomery Ward that adds a new dimension to wall paint.

To put a Mood finish on the wall, you first apply a base color. When it's dry, on goes a second color. Before this one is dry, you dab at it with a "Mood Maker"—a special rubber "squisher." It has a lacework of squeegee-like fins that smear the paint around, letting the base coat show through in some places, covering it in others. The result is 100-percent helter-skelter, and pleasantly interesting in a mottled, tortoise-shell sort of way.

Although Ward sells a kit (about \$7) including a 7" roller, plastic tray, dropcloths, masking tape, and a can of Mood, the key to the finish is the squisher, which costs about \$3. Ac-

tually, almost any paint will work, with some reservations:

- The base coat should be a semi-gloss, so the squisher will skid the paint around most effectively.

- The coat to be squished should be a bit thinner than ordinary wall paint and should have an oil base.

This coat must be rolled or brushed out quite thin, to avoid runs and sags. (A pile-type applicator works, too.)

There are no tricks. Just jab the Mood applicator against the wall in a series of interlapping jabs. Don't let it skid sideways. Don't twist it (unless you like the special effects that skids and twists produce).

The Mood finish invites experimentation. You could use a base coat of wide stripes of different colors. Or a random pattern of two colors. Or . . . you think it up.

The kit and Mood Maker are sold only at Ward's metropolitan retail stores.

Here's what you get

Tortoise-shell pattern offers handsome background for any decorating style, modern or traditional.



Plastic box in which Mood kit is packed serves also as paint tray for roller.

Your life is complicated enough.

We offer ***Simplicity***



Simplicity. The machines that make yard work easy to live with. Tractors, riding mowers, walk-behinds, too. Simplicity gives you non-scalp mowing... gives your lawn a smooth, even cut. And attachments are the fastest hitching in the business... go on and off in seconds. Make it easy to keep your Simplicity working all year long. That's

why Simplicity owners keep their equipment so long. Get more out of their machines while they're using them... more when they do trade them in. Simplicity. The mower to have when you've had it with all the others. 19 and 21" walk-behinds. 5 hp. to 15 hp. tractors. Simplicity Manufacturing Company, Inc., Port Washington, Wisconsin 53074.

There are 9 great mowers in the world. Simplicity makes 8 of them.





PS test cars, grouped on a curve, line up behind the Buick LeSabre (below). Next are Chrysler Newport Royal (left), the Mercury Monterey (above), and the Oldsmobile Delta 88 Royale (upper left).



PHOTOS BY A. J. HAND

Medium Standards: Are They Worth the Extra Cost?

Are you buying the prestige of a name, or genuine automotive values that you don't get in a Ford, Chevrolet, or Plymouth?

By JAN P. NORBYE / PS Automotive Editor and JIM DUNNE / PS Detroit Editor

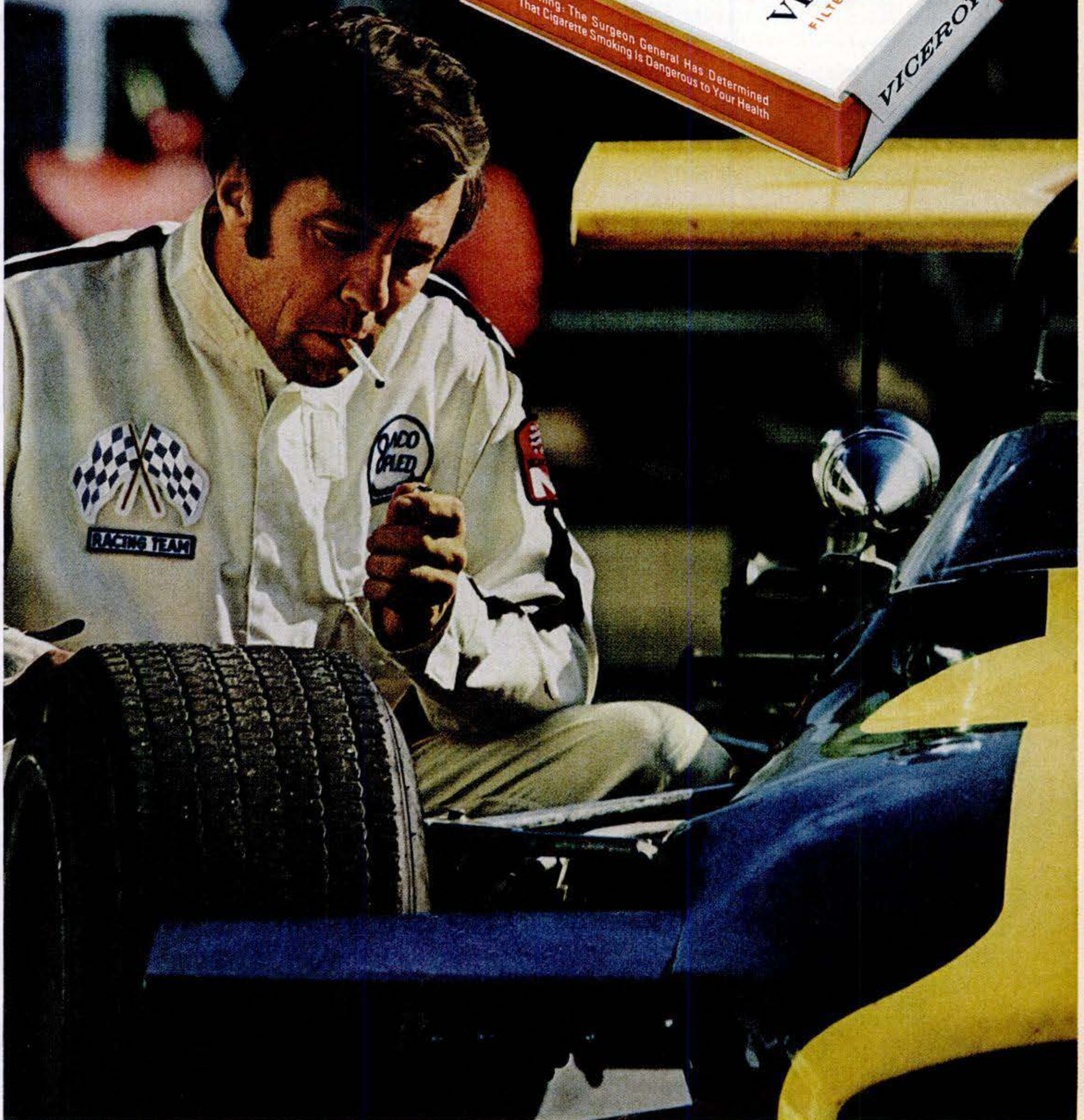
You're always being urged to "move up" when buying a new car. "Up" means progress, something better. You're asked to move up from Ford to Mercury, from Plymouth to Chrysler, from Chevy to Olds or Buick. "Up" also means more money. These cars cost more than the traditional "low-priced" three.

But what are you buying? A more prestigious name, a slightly longer and heavier car. Aren't you also buying a roomier and more luxurious interior, better quality, more refinement, superior engineering, and higher-grade finish?

Here are the facts: These medium standards are the lowest-ranking series within their lines of full-size
Continued

Get a taste of what it's all about.

Get the full taste of Viceroy.



17 mg. "tar," 1.2 mg. nicotine av. per cigarette,
FTC Report Aug. 71.

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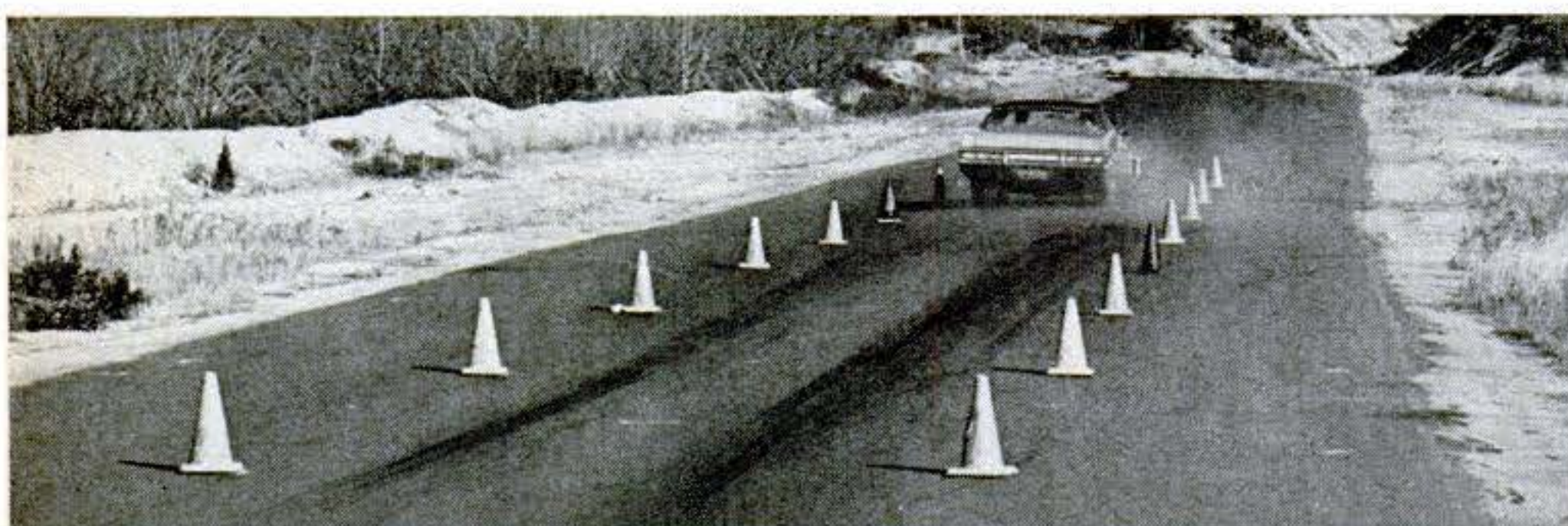
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Buick stopped with minimal rear locking, hot or cold, but suffered some fade after warmup.



Oldsmobile had stronger nose-dive, more rear-wheel locking, but was almost fade-free.



Mercury stopping distance went up after warmup; fading more than tripled pedal pressure.

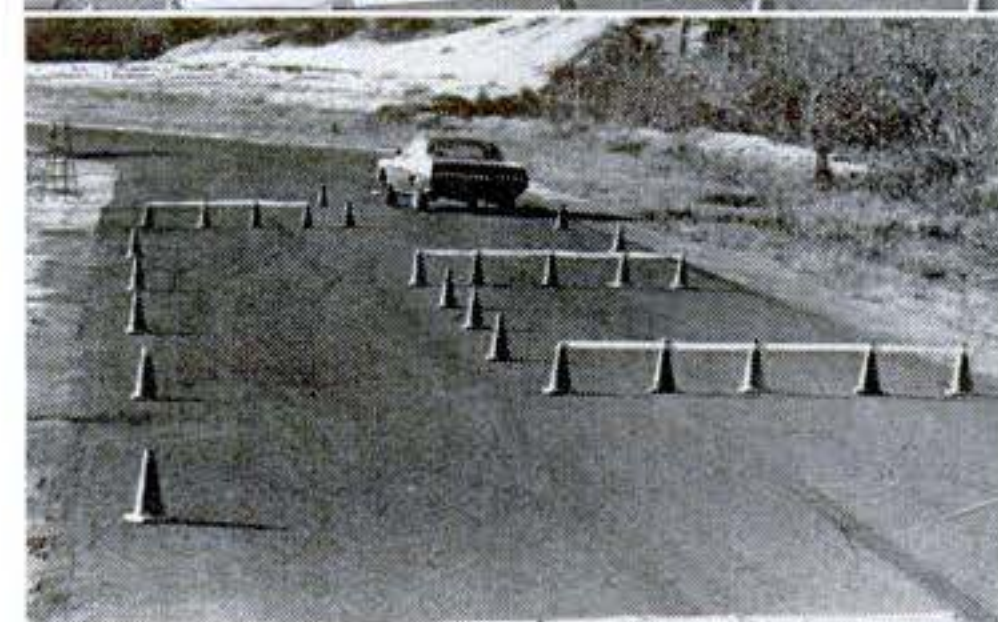
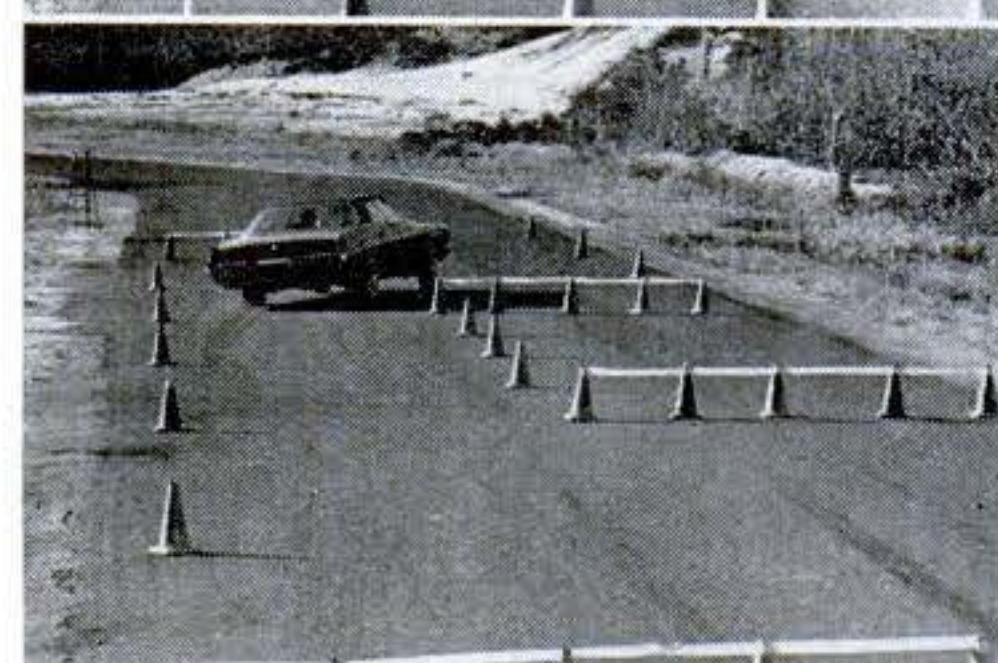
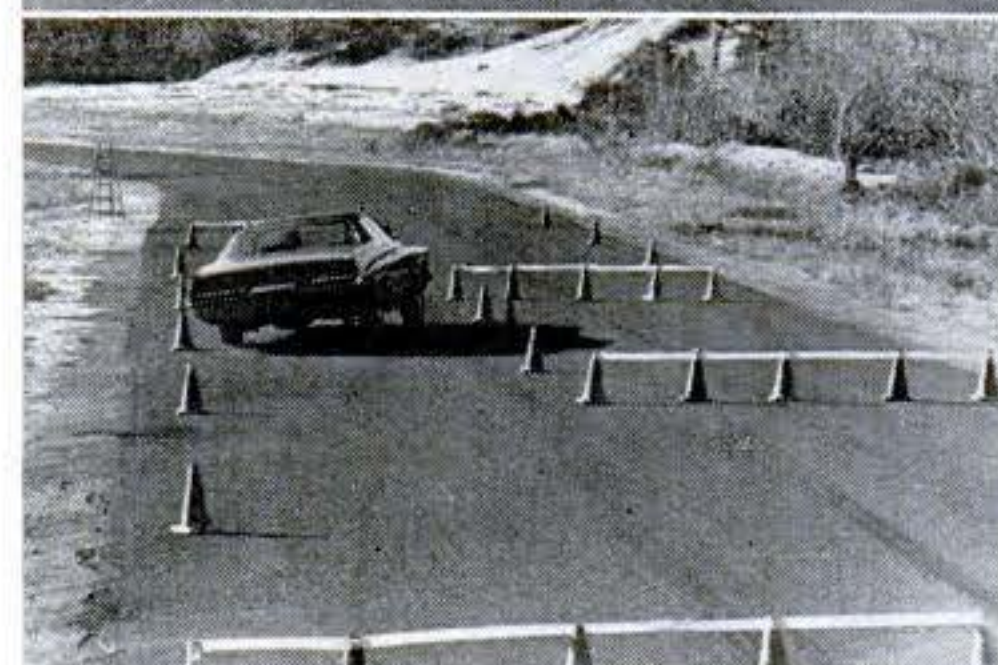


Chrysler took longest to stop with cool brakes, and highest pedal pressure after warmup.

cars. Although longer and more luxurious models with more lavish equipment are offered by all, we chose the top-selling cut-price versions for our tests.

The medium standards offer good passenger comfort, especially on long

trips. Their long wheelbases, heavy bodies, and favorable weight distribution give good directional stability and a pleasant ride. Their size and weight, plus extensive interior padding, mean extra passenger crash protection (passive safety), but not nec-



Buick in lane change was fastest. You can tell amount of drift from shadow in photo second from top, and rear-wheel slip from tail's proximity to extreme left of grid. Bottom picture shows fishtailing as car exits from grid in right-hand lane.

essarily more than in lower-priced cars.

Interior space is not much better than in the basic full-size cars—Chevrolet, Plymouth, Ford. Though wheelbases are somewhat longer, the bodies

Continued

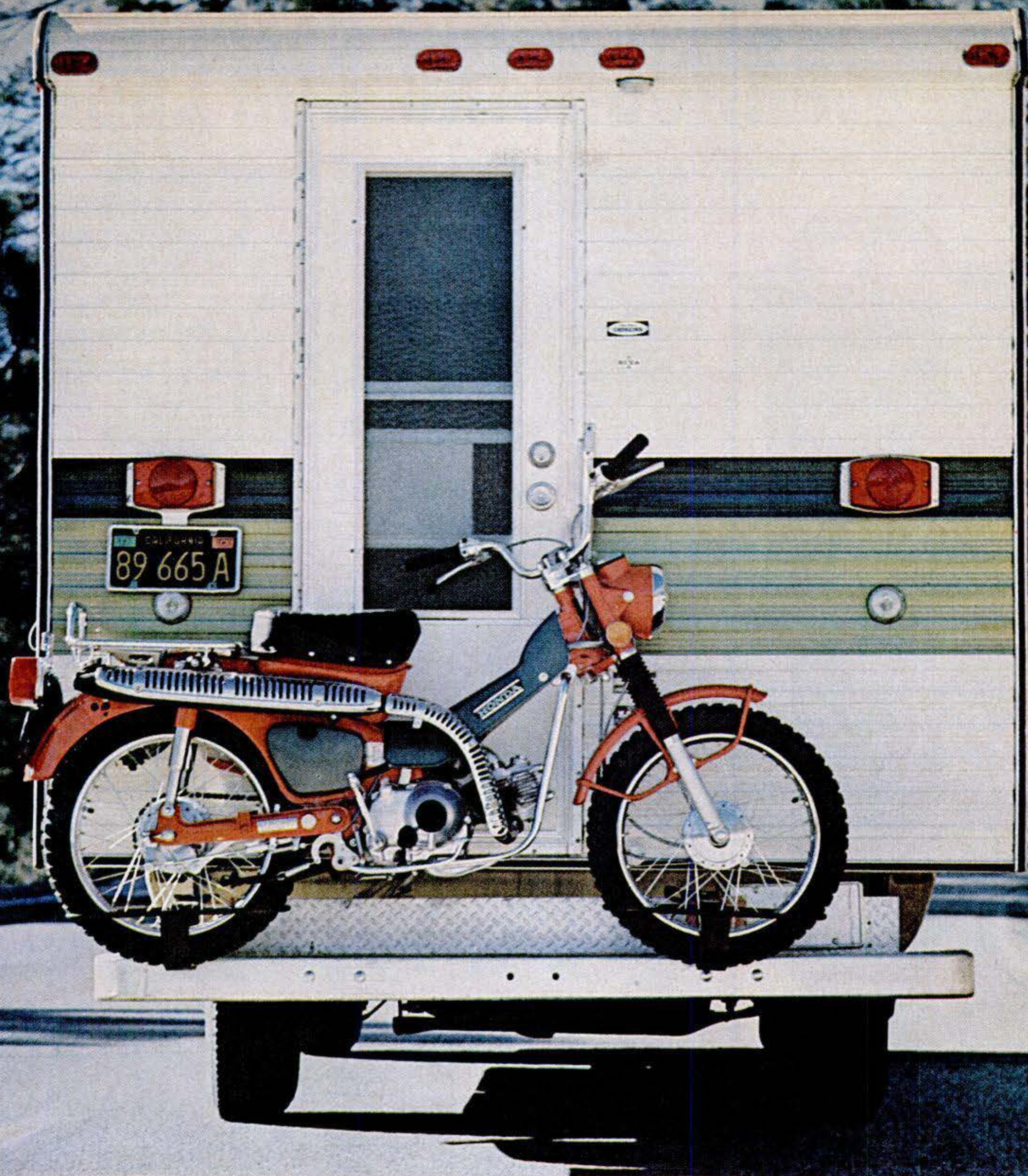


Chrysler responds quickly to the helm, but drifts sideways for long distances. In this

sequence, car hits cone in second barrier despite early heading for right lane.



Mercury was slowest in lane change, due to understeer (high front slip angles).



Pick up America's favorite hitchhiker.

When you get away to the country, give the Honda Trail 90 a lift. Once you get to where you're going, it'll return the favor.

The Trail 90 is America's favorite trail bike because it has the most to offer.

A famous Honda four-stroke engine for dependability.

Swivel-lok handlebars for



Reserve Tank

easy packing. Posi-torque dual transmission for rough or smooth riding. A great new reserve tank to carry extra gas or water. A USDA-approved spark arrestor/muffler to help protect the environment. And that strong Honda warranty to help protect you. The Honda Trail 90 is at your Honda dealer's now. Drop by. It's itching to go some new places with you.

The Honda Trail 90.

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3/4" Black Walnut
82"x19 1/2"x13"

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MODEL 300 GRANDFATHER CLOCK KITS

**solid three-quarter inch
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Regularly
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3 or more
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All pieces are pre-cut and pre-sanded. Waist and hood doors and dial frame are pre-assembled. Complete hardware furnished. Each piece may be re-ordered individually.

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Model 300-U Assembled unfinished Black Walnut Case, without movement	Reg. \$350.00	\$245.00
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ELEGANT DETAILS AND FEATURES OF MODEL 300

- full-turned hood columns
- breakfront swan neck and finial design
- famous West German movements
- full length waist door
- brass pendulum bob
- curved arch face door
- decorator sculptured base
- floor levelers

MAKE BIG MONEY BUILDING EMPEROR CLOCKS

Many hobbyists across the country have become regular Emperor Clock dealers, buying kits and movements for assembly and re-sale to friends, neighbors and retail stores.

SPRING SALE / MODEL 300 BLACK WALNUT

EMPEROR GRANDFATHER CLOCK MOVEMENT FOR MODEL 300 • WEIGHT-DRIVEN, EIGHT-DAY

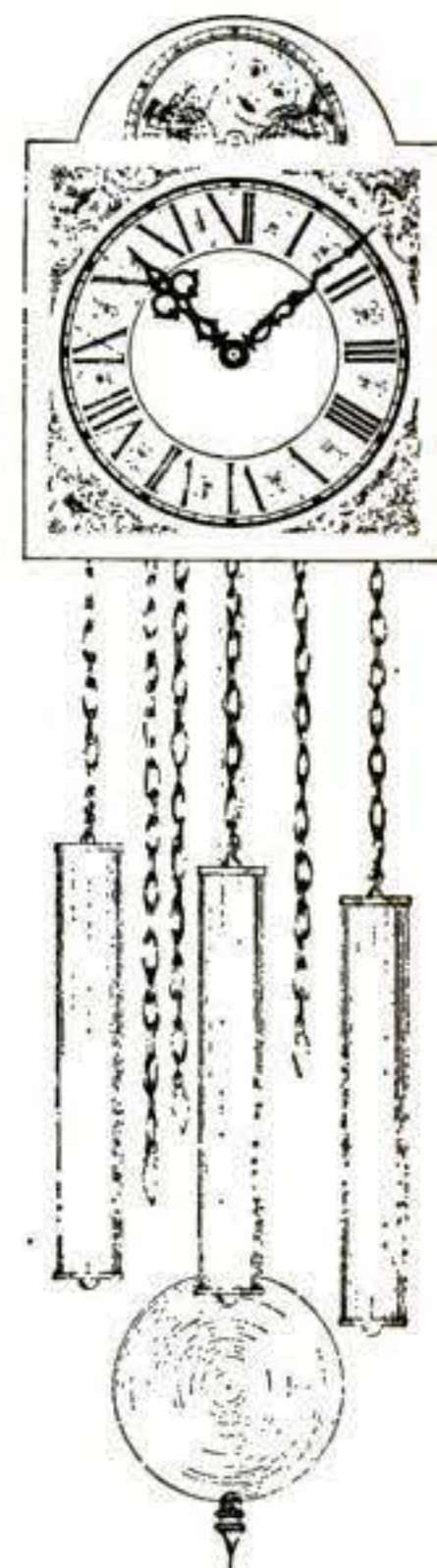
Emperor Grandfather Clock movements are manufactured by famous West German clocksmiths now in their third generation of producing the world's finest clock movements. The brass dial is surrounded by embossed overlays. The face has a high, permanent polish with serpentine hands. In the arch above the dial face is displayed a moving moon dial and lunar calendar.

The movement strikes four notes on the quarter-hour, eight on the half-hour, twelve on the three-quarter hour and sixteen on the hour. A Big Ben tone sounds the hour. All notes are struck on eight musically tuned rods. Movement 200-M sounds the famous Westminster chimes. Movement 300-M has a selection of three chimes: Whittington, St. Michael and Westminster. Installation and adjustment of the Emperor movement is simple, following the step-by-step instructions supplied. The movement includes weights, brass weight shells, brass bob, pendulum and chimes, ready for 15-minute installation.

IMMEDIATE DELIVERY — 1-YEAR WARRANTY

EMPEROR ANNOUNCES FREE JUNE CLOCKMAKING SCHOOL

In June, Emperor Clock Company will conduct a 2-day refresher and beginner clock-making school. The enrollment will be limited to 200. Registrations will be accepted on a "first come, first served" basis. If interested, register now.



MONEY-BACK GUARANTEE

All Emperor Clocks and movements are shipped on a 100% money-back guarantee.

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	Model 300-K Black Walnut do-it-yourself kit without movement	90 lbs.	\$199.00	\$149.00	
	3 or more kits, each			140.00	
	Model 300-U Black Walnut assembled/unfinished case without movement	85 lbs.	350.00	245.00	
	Model 300-A Black Walnut, finished clock, Westminster chimes and moving moon dial	125 lbs.	695.00	521.50	
	Model 300-TA Black Walnut, finished clock, triple chimes and moving moon dial	125 lbs.	745.00	556.50	
	Model 200-M Movement, Westminster chimes and moving moon dial	44 lbs.	159.50		
	Model 300-M Movement, triple chimes and moving moon dial	48 lbs.	189.50		
	Model 300 Detailed blueprint plans		3.00		

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ENCLOSED: ☐ Check \$

Alabama residents only, add 4%

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Card Number

Expiration Date

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Card Number

Expiration Date



Name

Please send FREE color brochure

Address

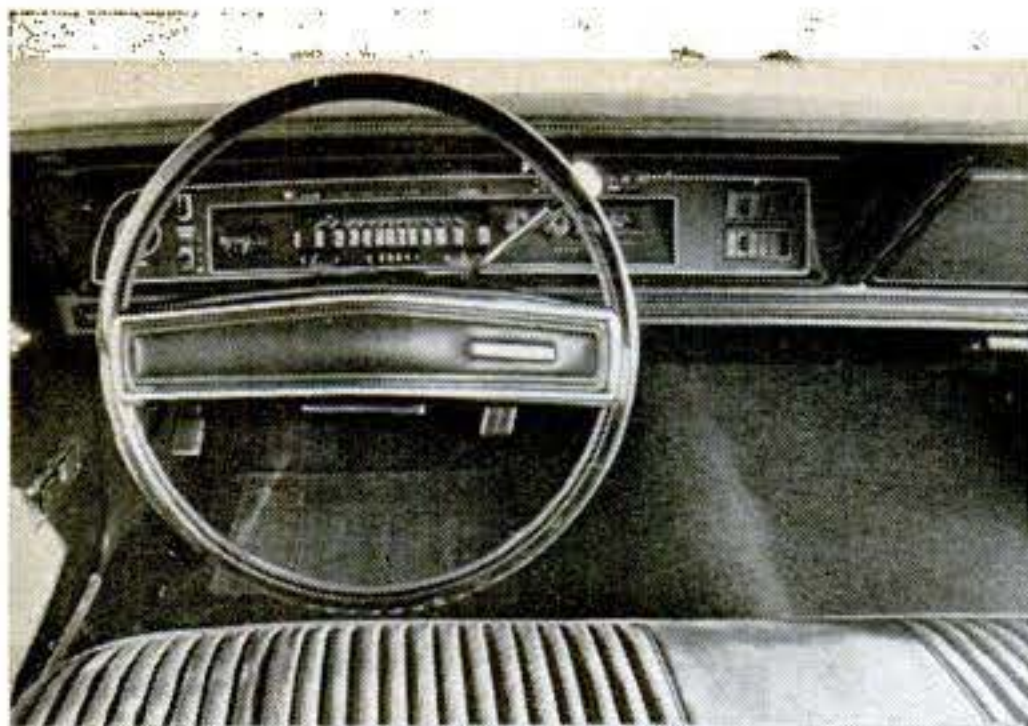
on complete Emperor line ☐

City

State

Zip

VISIT OUR PLANT, MONDAY THROUGH FRIDAY, 8 A.M. TO 5 P.M.



Chrysler driver has long reach to small controls, recessed into instrument panel.



Oldsmobile small controls differ in shape for touch identification (also on Buick).



Buick has easy-removal dash panels (like Olds) for access to switches and bulbs.



Mercury's brake release and cigarette lighter are unseen on underside of panel.



Electronic ignition is standard on Chrysler Newport Royal with the 440 V8. It gives better starting and longer plug life, and is practically maintenance-free.



Chrysler stands out as the only car in group with truly generous back-seat space. Lots of leg room is important on long trips.

are almost identical, and seating dimensions are about the same.

It's apparent that the makers have cut back on the quality of materials and attention to detail in these cars. They do not have the same finish and trim as their exact counterparts of five or six years ago. They are plain janes by comparison, hardly on a par with the latest Ford LTD, Chevrolet Caprice, and Fury Gran Sedan.

What about sound deadening? Noise levels were surprisingly high. Some readings were no better than in compact cars sold at half the price.

All were equipped with air conditioning, power steering, power disk brakes (front), and big optional V8s. All have the same body style—four-door hardtop—and ventless doors.

Buick and Oldsmobile. They share many components, have many features in common, yet have different engines and brakes. Suspension links may be the same; spring rates aren't. You'll find important differences in performance, too (see test results).

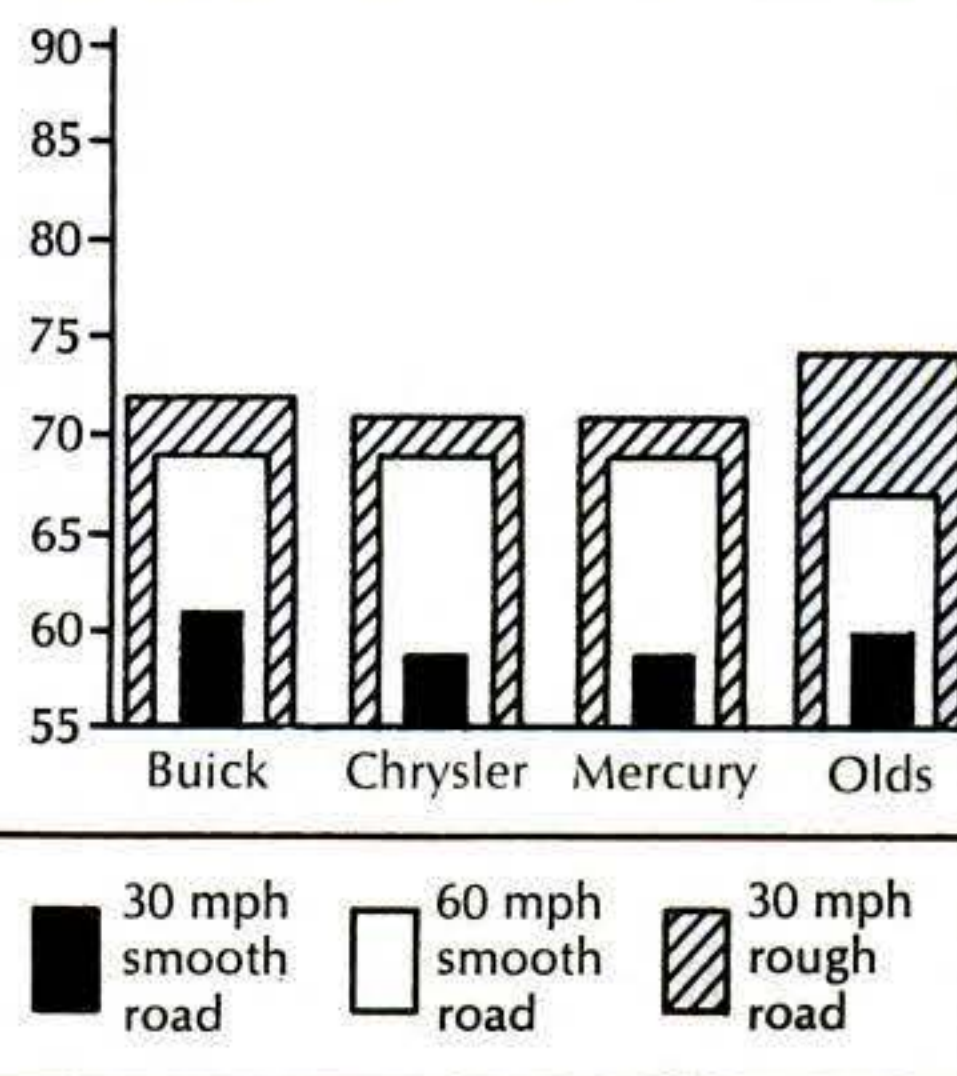
Buick has its own semiclosed cooling system, so you can check coolant level by looking at a translucent reservoir, which you can refill without removing the radiator cap.

Oldsmobile has a spring-mounted five-mph front bumper that returns to original position after impact. It will protect lights, grille, and sheet metal.

You have to be a contortionist to enter or leave the back seat in both GM cars. Curved side glass cuts off the door opening, and leg room is restricted. Even your approach to the driver's seat must be made with care.

NOISE-LEVEL TESTS

We measure interior noise in decibels under three sets of conditions, on three different scales. For quick reading of the results, we give you only the A-weighted scale, which is most like human hearing in overall sound pickup. A decibel difference of one or two points is perceptible to a driver; five points make enormous difference.



Curved rear doorposts cut into back-seat foot space at their base.

Underhood access is fair on both, even with A/C. Buick has the distributor up front, Olds against the fire-wall. Olds plugs are in the open, while Buick plugs are recessed at angles, pointing fore and aft.

Both have windshield antennas and inside hood locks as standard. Brake-release knobs are in easy reach. On both, the radio-volume control button is obstructed by the transmission lever when in Drive position.

Buick has two minus points not found on the Olds. First, you can't see into the glove box without bending down—it's too low. Second, the average driver can't see the top of the right-front fender—a handicap when you're parking in tight places.

Chrysler Newport Royal. It has the largest interior. Leg room alone is a major plus point, and entry/exit are easier than in the GM cars. The body is shaped for tight maneuvering, and you can see both front fenders from behind the wheel. It has an inside hood lock, two vents in the kick panels, and a large, useful glove box.

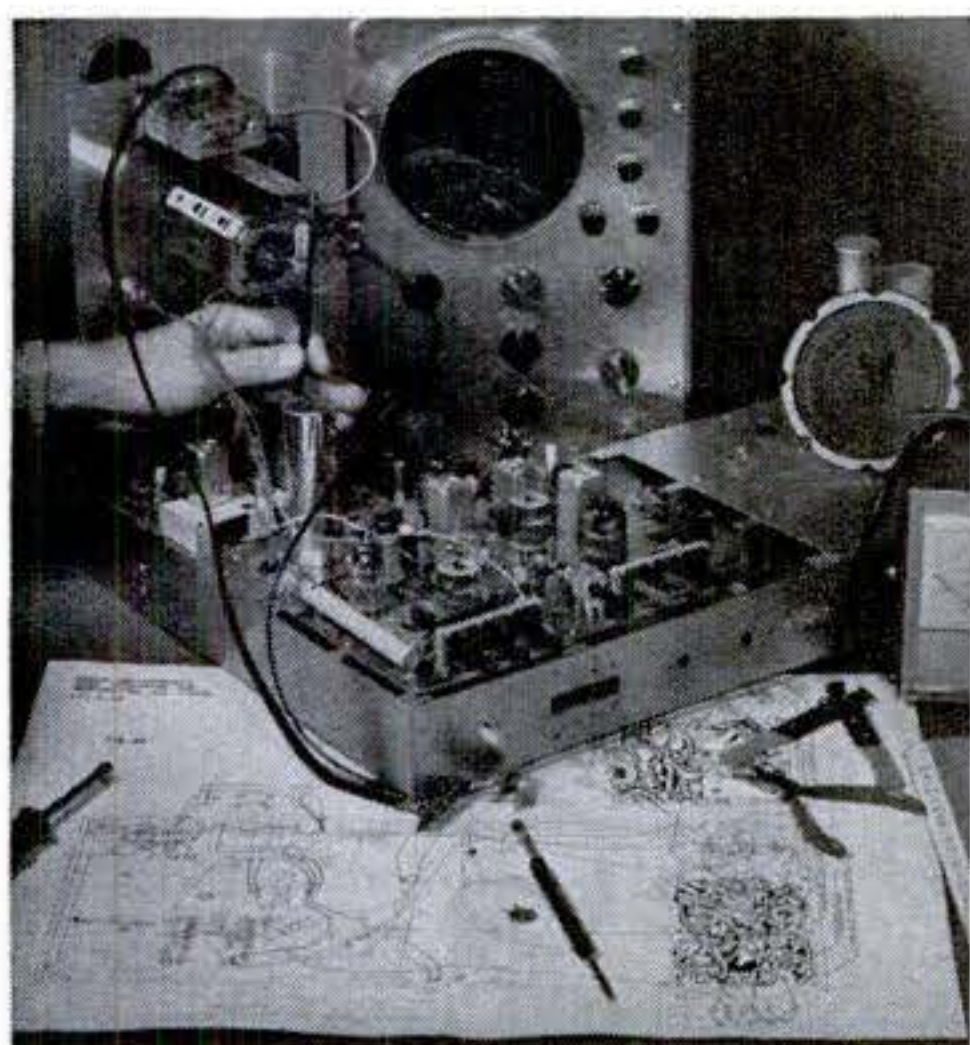
A stainless-steel antenna is designed to discourage vandals. The parking-brake release is set very low (five inches from pedal). Spark plugs are hidden under exhaust manifolds, and difficult to change.

Mercury Monterey. Here interior space is good, but not as great as Chrysler's. Back-seat entry, however, is awkward, though not as bad as on the GM cars. Forward visibility is

Continued

3 needed skills NRI can teach you at home

NRI courses use "bite-size" texts to show you how to service TV-Radios, Repair Cars or Appliances



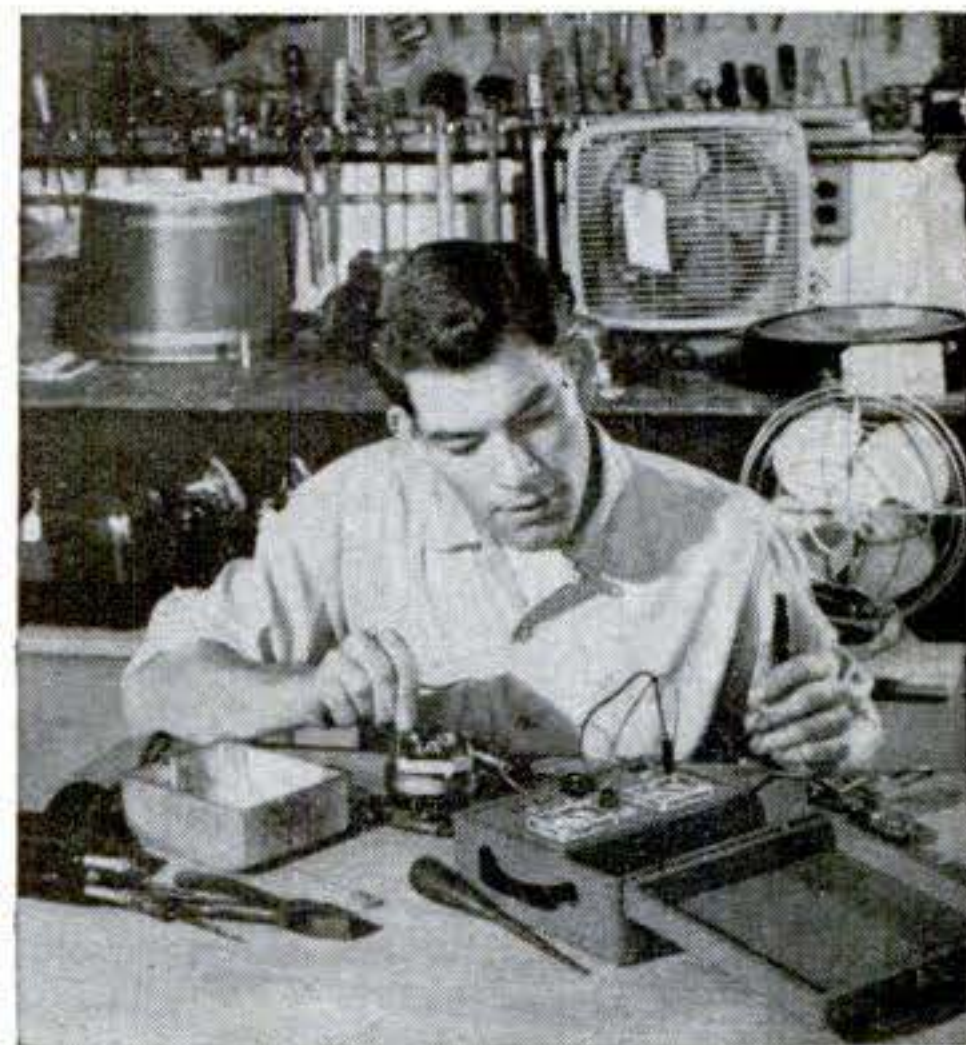
TV-Radio Servicing

The NRI TV-Radio Servicing course includes your choice of black and white or color TV training equipment. NRI courses cover FCC license preparation, complete communications electronics, aircraft electronics, mobile communications, marine electronics, amateur radio, industrial and business electronics.



Automotive Repair

Take your choice of Master Automotive Technician training or a shorter Automotive Tuneup and Electrical Systems course for the man seeking greater understanding of basic car repair. Both courses include professional equipment so that you get "hands-on" experience and the chance to earn spare-time money making repairs.



Appliance Repair

NRI trains you to fix all kinds of electrical appliances, plus air conditioners, refrigerators, house wiring, electric motors, even small gas engines. An appliance tester is included for fast trouble shooting, so you can begin earning money repairing appliances long before you finish the course.

"Hands-on" training pays off

NRI was the first to supply home study students with custom-designed training kits to give practical hands-on experience as you learn. You get more value from the exclusive Achievement Kit sent the day you enroll, to "bite-size" texts and training equipment. Learning TV-Radio, Automotive Servicing and Appliance Repair at home is easy, exciting, the simplified, dramatized NRI way.

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Tens of thousands of NRI graduates are proof it is practical to train at home in your spare time. Keep your present job while preparing for a better one and earn \$5 to \$7 an hour extra in your spare time.

Fix your own equipment, or earn money making repairs for friends and neighbors. NRI shows you how.

Train with the leader—NRI

The same training innovations which have made NRI the leader in career training at home is now available to you. Let NRI help you step up to better pay, a brighter future. Decide now to move ahead . . . the decision is yours to make. Mail the postage-free card today for a free full-color catalog in the field of your choice. No obligation. No salesman will call.



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3939 Wisconsin Avenue
Washington, D.C. 20016

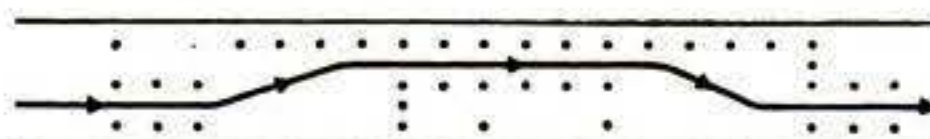
How other cars have fared in our tests

	CHEVROLET CHEVELLE	CHEVROLET KINGSWOOD	FORD TORINO	FORD COUNTRY SQUIRE	MATADOR BY AMERICAN MOTORS	PLYMOUTH SATELLITE	PLYMOUTH SPORT SUBURBAN	MERCEDES- BENZ 250	CITROEN DS-21	AUDI LS-100	PEUGEOT 504	VOLVO 144-S
Accel. 0-60	11.4	13.4	14.3	12.75	10.3	12.6	11.3	14.05	18.2	13.4	15.8	14.2
Accel. 0-80	20.45	22.5	27.6	23.35	20.4	22.55	20.6	23.75	32.4	24.1	36.0	28.3
Accel. 25-70	11.75	14.0	15.65	14.3	12.05	14.25	13.6	15.1	18.6	15.0	20.2	14.7
Brakes 60-0	180.6	156.3	173.3	149.5	141.8	151.3	203.8	126.5	146.3	155.0	133.0	142.9
Lane change	54.5	50.5	53.0	48.5	56.3	53.0	49.9	60.0	60.0	54.6	57.25	51.45
Slalom	23.9	24.6	21.8	22.1	24.6	25.3	21.1	28.6	28.1	26.4	26.5	24.4
Fuel (mpg)	15.45	10.12	17.36	10.42	18.78	15.96	10.6	12.82	26.57	17.4	20.2	19.6
Noise (60 mph)	70	73	70	69	73	73	69	74	73	76	78	78
Price	\$4,094	\$4,852	\$4,308	\$4,760	\$3,790	\$4,255	\$4,617	\$7,221	\$5,561	\$4,019	\$3,317	\$3,357

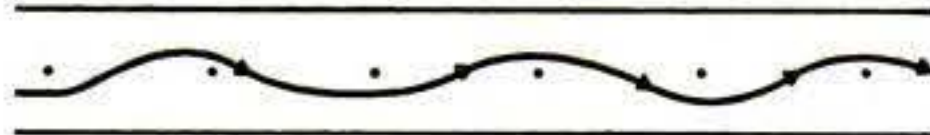
How PS tests cars—and what the tests show

Brake test shows a car's ability to stop from 60 mph without wheel locking. Test is first made with cool brakes, then repeated after 10 warmup stops from 60 at one-minute intervals with 0.5g deceleration. First test shows braking capacity, balance; the second, fade. Excessive pedal pressure indicates fade. Excessive distance indicates fade, incipient or partial locking, or combination of both.

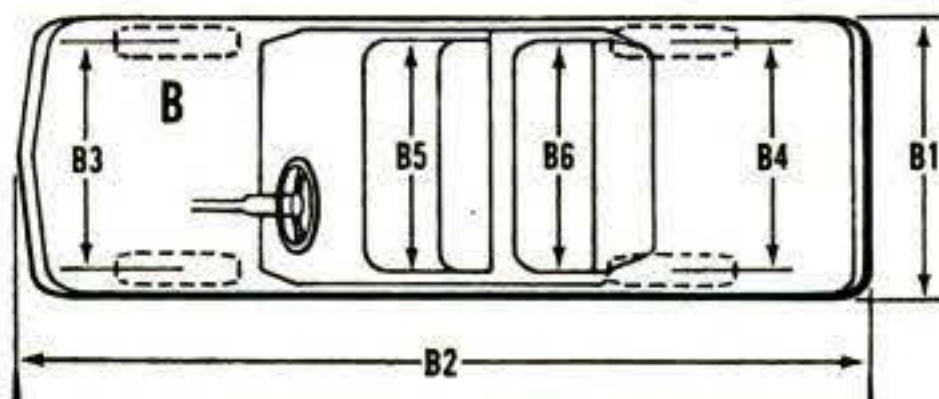
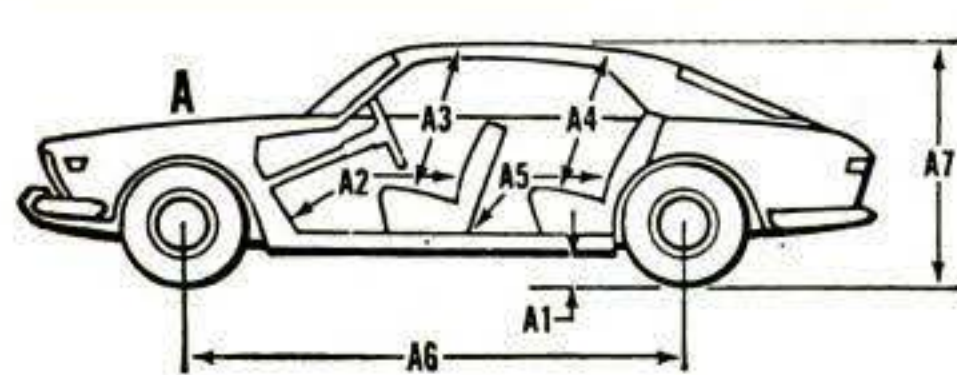
Acceleration test at 0-60 mph shows a car's ability to reach cruising speed from standstill. The 0-80 mph test shows its high-speed power reserve; 25-70 mph test simulates a highway merging situation. Cars with automatic transmission are tested in DRIVE.



Two lane changes in quick succession show a car's ability to make an emergency maneuver at speed. Lanes are blocked 120 feet apart, and lane-change gaps are 60 feet long. Each car is put through test at increasing speed until its maximum is established.



Low-speed emergency maneuver test means snaking a car as fast as possible through pylons 48 feet apart. In both handling tests, times clocked by two stopwatches are converted to mph.



DIMENSIONS (inches)	BUICK Le Sabre	CHRYSLER Newport Royal	MERCURY Monterey	OLDSMOBILE Delta 88 Royale
A1 Ground clearance	5.5	6.2	4.6	5.6
A2 Front leg room (max.)	42.6	41.8	41.7	42.4
A3 Front head room	38.9	38.1	37.7	39.0
A4 Rear head room	38.0	37.0	36.7	38.0
A5 Rear leg room (min.)	38.8	41.5	39.7	38.8
A6 Wheelbase	124	124	124	124
A7 Height	54.4	55.0	54.0	53.4
B1 Width	80.0	79.4	79.3	79.5
B2 Length	221.9	224.1	224.7	222.1
B3 Front track	63.6	62.1	63.3	63.6
B4 Rear track	64.0	63.4	64.3	64.0
B5 Front hip room	62.0	63.3	62.3	62.2
B6 Rear hip room	61.9	63.3	62.3	62.1
SPECIFICATIONS				
Engine type	OHV V8	OHV V8	OHV V8	OHV V8
Displacement (cu. in./cc)	455/7,455	440/7,202	429/7,033	455/7,458
Compression ratio	8.5:1	8.2:1	8.5:1	8.5:1
Carburetion	One 4-bbl.	One 4-bbl.	One 4-bbl.	One 4-bbl.
Net hp @ rpm	225 @ 4,000	245 @ 4,400	205 @ 4,400	225 @ 3,600
Net torque @ rpm	360 @ 2,600	360 @ 3,200	322 @ 2,600	360 @ 2,600
Transmission	3-sp. auto.	3-sp. auto.	3-sp. auto.	3-sp. auto.
Axle ratio	2.93:1	2.76:1	2.75:1	2.73:1
Tire make	B. F. Goodrich	Goodyear	Firestone	General
Tire type	Silvertown Belted	Polyglas	Sup-R-Belt	Belted Jumbo
Tire size	H78-15	H78-15	H78-15	H78-15
Turn diameter	44.1 ft.	44.75 ft.	46.5 ft.	44.8 ft.
Turns, lock to lock	2.9	3.5	4.0	2.9
Brakes	Power: disk/drum	Power: disk/drum	Power: disk/drum	Power: disk/drum
Fuel tank (gal.)	25	23	22.5	24
Trunk space (cu. ft.)	17.0	22.4	18.2	17.0
Liftover height	25.6	26.6	28.8	25.6
Curb weight (lbs.)	4,638	4,590	4,707	4,565
TEST RESULTS				
Acceleration 0-60 mph	11.0 sec.	10.35 sec.	11.35 sec.	9.65 sec.
Acceleration 0-80 mph	20.5	18.75	22.4	15.8
Acceleration 25-70 mph	12.05	11.3	13.25	10.1
Braking dist. (cool) 60-0 mph	129 ft. 7 in.	146 ft.	130 ft.	135 ft.
Pedal pressure	70 lbs.	65 lbs.	60 lbs.	60 lbs.
Braking dist. (hot) 60-0 mph	183 ft. 2 in.	175 ft. 2 in.	183 ft. 5 in.	154 ft. 3 in.
Pedal pressure	100 lbs.	200 + lbs.	200 lbs.	100 lbs.
Max. speed—lane change	54.5 mph	51.3 mph	49.9 mph	53.0 mph
Max. speed—slalom	22.4 mph	22.4 mph	21.8 mph	22.7 mph
Gas mileage (const. 45 mph)	12.245 mpg	11.622 mpg	10.538 mpg	12.513 mpg
Price (basic)	\$4,029	\$4,135	\$4,075	\$4,188
Price (as tested)	\$5,188	\$5,315	\$4,812	\$5,231

good, with both fenders in view. The parking-brake pedal is poorly placed for use in an emergency, and the car has no inside hood lock. With A/C, the Ford 429 V8 has near ideal accessibility, with the distributor in front, and plugs easy to get at.

Conclusions:

Dunne: My choice is Chrysler. It has what I look for in a big car—space and comfort, convenience and practicality. It has great down-the-road stability, plenty of power, and creditable fuel economy.

Norbye: Oldsmobile is my pick. It beats the others on acceleration and gas mileage, and clearly has the best brakes. It's also the quietest on the highway. The quick variable-ratio power steering is way ahead of the Ford and Chrysler systems, and the Olds is almost as good as Buick in high-speed maneuverability. **P 5**



Front view: Chrysler, Mercury, Buick, Olds (top to bottom). The GM cars have parking lights showing full width of car; others don't. All have dual headlights.



A special offer for the guy who knows what the underside of a car looks like.

If you've been under a car, you know what's connected to what and why, and you've probably got more than a little Missouri in you. So when someone starts up about his shock absorbers, stop him with a "Show me." We will.

You buy our Pleasurizer H.D.'s and test them for three months. Make them do everything shocks are expected to do, and don't be gentle. If at the end of 90 days you're not satisfied, your participating dealer will give you your money and your old ride back. We're that sure of them.

Delco H.D.'s are stiff. To give improved handling in tough situations. Even if you're running over-

size wheels and tires.

And H.D.'s are tough all around. On long work-outs, the large fluid capacity helps dissipate heat fast. And H.D.'s have a special Genetron® gas filled cushion to prevent air bubbles and the shock lag they can cause.

Your Delco dealer has a complete line of shock absorber replacements for all American-built and most foreign cars. The H.D., the Pleasurizer, and the air adjustable Pleasur-lift. All with the 90-day money-back offer. We're that sure. Stop at the red, white and blue Delco sign. And you can be sure too.

The more you know,
the more you'll want Delco.



Recreation Roundup

...on the move with PS

By HERBERT SHULDINER

Off-road vehicles under fire

By the time you read this, a long-awaited federal report said to be highly critical of off-road vehicles may have been pried out into the open. This report—now pigeonholed by the Interior Dept.—was written by a U.S. Bureau of Outdoor Recreation task force assigned to investigate the ecological impact of off-road vehicles. It was intended to advise whether any federal controls are warranted.

The report may lead to far greater control of all off-road vehicles in national parks and forests, and in all other recreation areas as well, because of potential harm to the ecology of these places.

When coupled with recent Senate hearings and an increasing body of hostile legislation being passed by a number of states, this may make it more difficult to find places to use snowmobiles, trail bikes, dune buggies, and ATVs.

Experimental mini motor home



U.S. Steel's Galavant is an "idea" RV that embodies a lot of attractive features. It has a welded all-steel frame that gives extra strength and design freedom for a raised roof (more headroom) and a roomier front bunk. Steel sheeting covers it to form an attractive skin when painted. U.S. Steel says that all channels and sheeting can be cut, bent, or shaped without costly special tools. The steel frame is now used in only a few expensive full-size motor homes. Mini-motor-home manufacturers might do well to consider use of this new technology, which could result in stronger RV structures.

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Trying harder for campers

The perennial number two car-rental firm is making a big pitch to become first in the rental motor-home market. Avis recently took the plunge into the RV business by offering futuristic Discoverer motor homes in 10 cities—San Francisco, Los Angeles, Phoenix, Tucson, Orlando, Miami, New York, Denver, Seattle, and Boise.

Rates in season range up to \$355 per week and 12 cents per mile for the 25-foot motor home, which sleeps six. An inviting feature of the plan: You can also drop the Discoverer off at any of the 10 cities named.

Hertz started motor-home rentals last year.

Chevy readies a pickup surprise

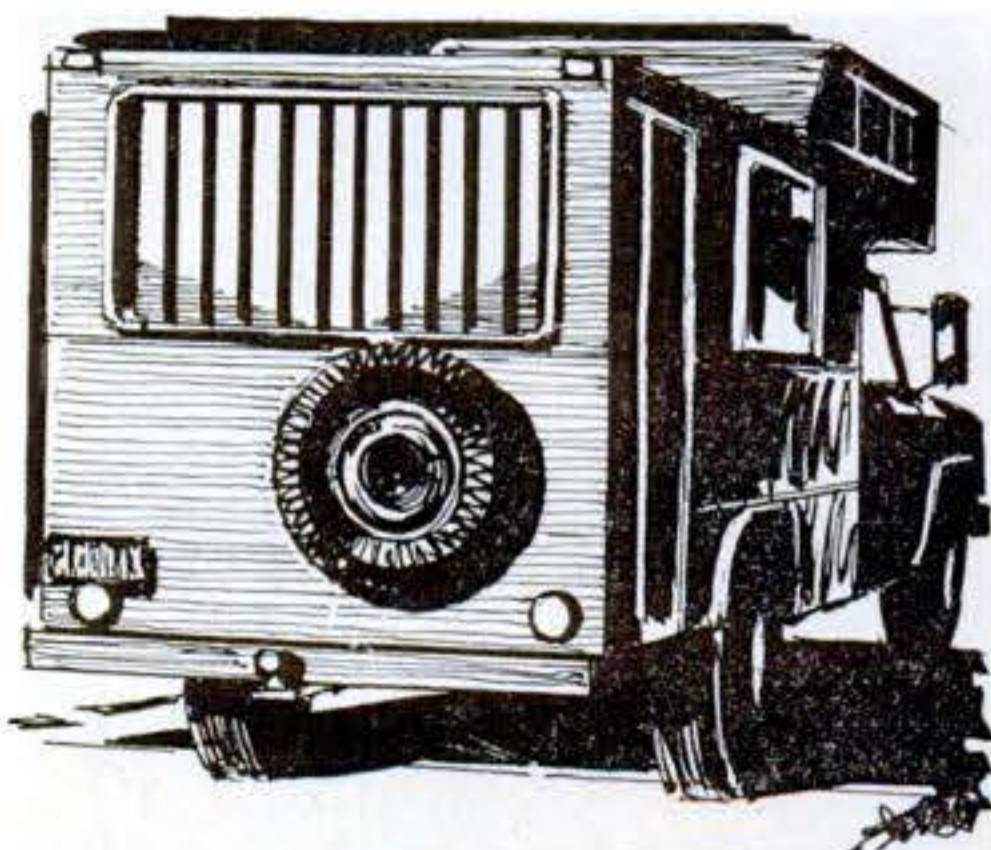
The '73 Chevrolet camper special will offer an optional four-wheel rear axle. This is a first for light pickups. The new rear axle will enable pickups to carry heavy camper bodies with a greater degree of safety. You can expect more surprises in other '73 camper specials, for Detroit now realizes how significant camper specials are in pickup sales nationwide.

Things to write for

A handy aid for owners of motor homes built on Dodge chassis is a revised Truck Service Directory which lists names, addresses, and phone numbers of over 1,300 Dodge dealers. The directory is free from Dodge Service Dept., PO Box 1259, Detroit, Mich.

"Weigh to Go" is a new booklet that tells how to match a camper to your pickup, and what you should know about safe towing. You can get it at Ford dealers or from Box 1000, Dearborn, Mich.

The do-it-yourself outdoorsman



Reader Gary L. Hayden of Glen Ellyn, Ill., sends along this clever safety-device idea for RVs: You install a 12-volt light at the base of an RV's rear window, and attach vertical strips of reflective tape to the outer face of a roll window shade. When you're traveling at night, or parked, just pull down the shade and turn on the light.

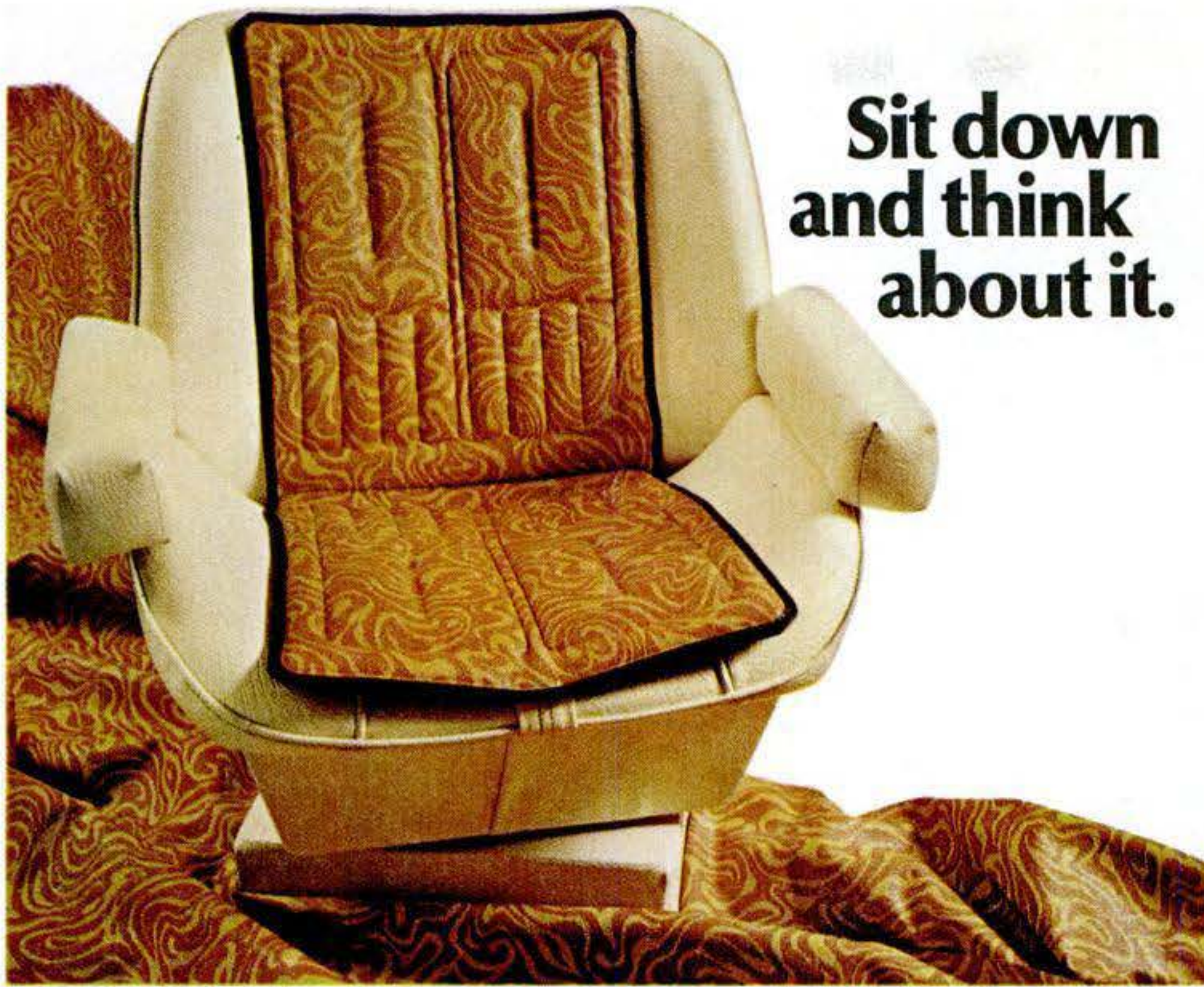
New backpacker sleeping gear puts you on man-made cloud



DuPont's new Dacron II is gaining popularity as a substitute for down. Coleman offers four backpack sleeping bags insulated with this new man-made

material, said to compare favorably with down in lightness and warmth. Two are in mummy style (shown above) and two others are rectangular.

All boats are not created equal.



**Sit down
and think
about it.**

Your Larson dealer has this superb seat waiting for you on his showroom floor. You'll find it by the pair in many new Larsons this year. Have a seat and give some thought to the many exceptional differences in Larson '72 that spell extra value.

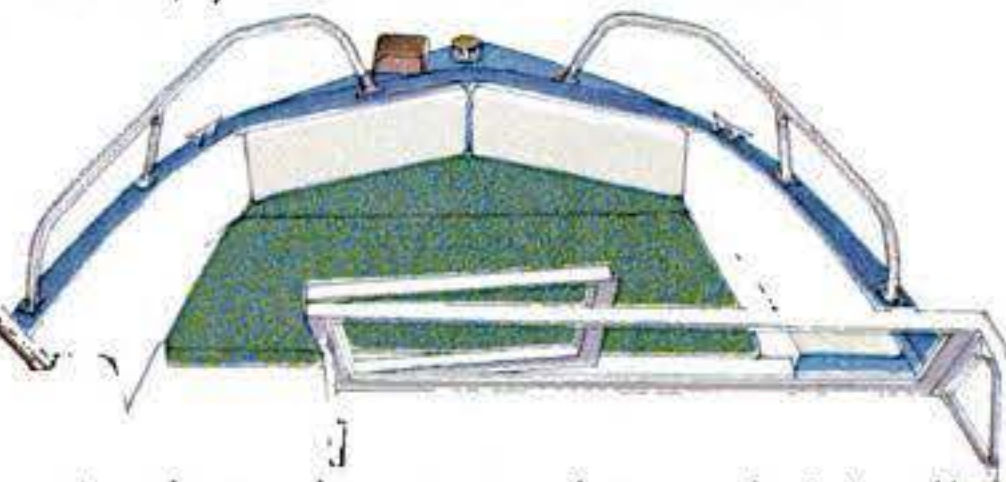
As soon as you sit down you'll know this new boat seat is unlike any other. The bottom and back are contoured and cushioned to fit yours.

And when you lift the levers under the arms, the back reclines. Your mate can swing around to talk comfortably with you while facing the stern. You can swing toward her. Yet you're still within comfortable reach of the wheel and all other controls.



The 18 ft. Shark Stern Drive model has a wrap-around control panel. And every '72 Larson has padded dash and padded coaming.

Reach up now to the top of the windshield frame and pull yourself up. Sturdy, isn't it. If you've tried that on others, you'll feel the difference.



Look at the space forward. It's all flat and cushioned. You can stretch

out in any direction. Or you can stow one section of cushions to convert the forward area to conventional seating. And there's a well for stowage or ice under the middle cushion. The new left side walk-thru makes it easy to get to the forward deck without disturbing the driver.

There's even a locking beverage bar to hold glasses and bottles secure.



We've thought of some other simple things, too. Like molding non-skid step areas on gunwales, and at the bow on Shark models.

And a very functional but unobtrusive bow light that has the big advantage of providing more step area for beach boarding. (Speaking of lights, every '72 Larson has an interior courtesy light; all Stern Drives have an engine box light.)

Notice the new stern seat. It's curved to fit the way people



like to sit. By the way, the tables double as footrests for forward or stern seats. They stow neatly on the side panels when they're not in use.

There are many more innovations your Larson dealer would like to show you. All in the category of "value added by engineering for people."

During Larson's 58 years of boat-building, more people have bought Larson than any other brand of run-about. This year's innovations add to the value that's been so traditional.

Larson's differences make boating more fun and give you more value for your boating dollar. Your Larson dealer hopes you'll make your own comparison.



All American Boats for '72

Larson Boat Division, Larson Industries, Inc., Little Falls, Minnesota 56345





Today, a man needs a good reason to walk a mile.

Start walking.



25 mg. "tar," 1.5 mg. nicotine av. per cigarette, FTC Report AUG. '71.

PS: What's News...

Keeping You Posted from Behind the Scenes

Rarely does our Consulting Editor for Space, Dr. Wernher von Braun, write for us about anything that flies as low and slow as a commercial airliner. But when I visited him in Washington to plan the stories he would write for us in 1972, I couldn't get him to talk about articles on space until he had given me an enthusiastic description of NASA's latest research on aircraft. The plane he told me about is important news to every one of us. Let him tell you why in his article about the Advanced Technology Transport (ATT), page 68.

We sent cover artist Pierre Mion to NASA's Langley Research Center in Hampton, Va., to study their scale models of the ATT. They actually removed one of the models from the wind tunnel where it was undergoing tests so that he could examine it close up and photograph it. Result: Our cover painting this month is an accurate representation of two versions of the commercial airliner you'll be flying in before the end of this decade. When you step aboard, remember where you first read about it.

There is something you can do

The Car Care Council, Inc., a nonprofit informational organization, recently called my attention to this excerpt from the Congressional Record:

A RESOLUTION:

That the President is authorized and requested to issue a proclamation designating the month of April, 1972, as "National Check Your Vehicle Emissions Month" and call upon the People of the United States to take their vehicles into the repair shop of their choice to have the emissions checked and their vehicles adjusted where necessary, so that we can substantially reduce air pollution from the 110 million motor vehicles operating on the streets and highways.

Wordy, but you get the message. If our environmental protection laws are to be effective, you and I will have to support them with our actions.

Pancakes and printed circuits

By curious coincidence, I received three letters last week relating to an article we published 12 years ago. One reader had "invented" a printed-circuit motor and wondered if I knew of any applications for it; another had heard of a motor with the armature windings printed on an insulating board like a TV circuit board; and a man with a long memory asked, "Whatever happened to that pancake motor I read about in PS April 1960?"

The headline on our article said, "New Pancake Motors Have Printed Windings." Sound far-fetched? It may have seemed so at the time, but a telephone call to the Photocircuits Corporation in Glen Cove, N.Y., turned up a happy success story. You're not likely to find one in a home appliance, but the printed motor has captured a vital role in specialized industrial instruments and machines. Briefly, it's a permanent-magnet motor in which the armature speed is exactly proportional to the applied voltage. The armature has so little inertia that it can start and stop as fast as a thousand

times per second! If you want more information you can write to the PMI Division, Department PSM, Photocircuits Corp., 31 Sea Cliff Ave., Glen Cove, N.Y. 11542.

Horological mystery revealed

Remember our January story on the new quartz watches? Remember, too, Timex's mystery circuit? Our electronics editor, Bill Hawkins, speculated that it might be some kind of analog circuit, as we mentioned in the caption on Timex's watch. The Timex patent reveals that it *was* an analog means of controlling the watch's speed. Briefly, here's how it works: There's a high-frequency quartz oscillator controlling two multivibrators which beat together to form a resultant frequency. This frequency is divided down to pulse into a unique indexing system in which a mechanical oscillator pulses at five times per second. This drives the watch's hands like an ordinary watch.

Come with me to the Descartes Region

That's the invitation Gene Simmons extends to you with the booklet he has written, *On the Moon with Apollo 16, A Guide to Descartes*. If you're a hard-core space buff, you'll want it in hand from the moment of blast-off April 16. Referring to it while watching the TV spectacular will be like having the Chief Scientist of the Manned Spacecraft Center sitting beside you giving you a minute-by-minute description of what will happen next and why—ready to answer almost any question that might occur to you, and able to show you diagrams, drawings, and charts to explain what you're seeing on your TV screen. Gene Simmons, of course, was Chief Scientist of the Manned Spacecraft Center for two years and is now Professor of Geophysics at MIT. He sent me a copy of the typescript so I could tell you about it in time for you to order a copy. It's for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for \$1.

1872-1972: century of wonders

We are in the middle of our final preparations for our May 100th Anniversary Issue, and now I can tell you that some of the most distinguished scientists of the Twentieth century are writing articles for you. We'll have bylines such as Edward Teller, William Shockley, Charles Townes, Dennis Gabor, Peter Goldmark, Joseph Weber, Buckminster Fuller, and, of course Wernher von Braun. You'll also be seeing our usual variety of outstanding articles by top magazine writers and a sneak preview of an important consumer-product development that I can't tell you about yet. It will be a fat issue, packed with surprises, including fresh new project designs by Buckminster Fuller, Ken Isaacs, and Les Walker, and plans for an exciting new sailboat you can build yourself.

Hubert P. Luckett

Editor-in-Chief
APRIL 1972 | 65

ALCOA

How to find a needle in the world's darkest haystacks—the deep oceans

By ARTHUR FISHER

ILLUSTRATIONS BY PIERRE MION

Suppose you lost something valuable in the depths of the sea. How would you go about getting it back?

The problem has proved of nightmare difficulty in several recent search and recovery missions, for objects ranging from an H-bomb off the coast of Spain to a nuclear sub in more than 8,000 feet of water.

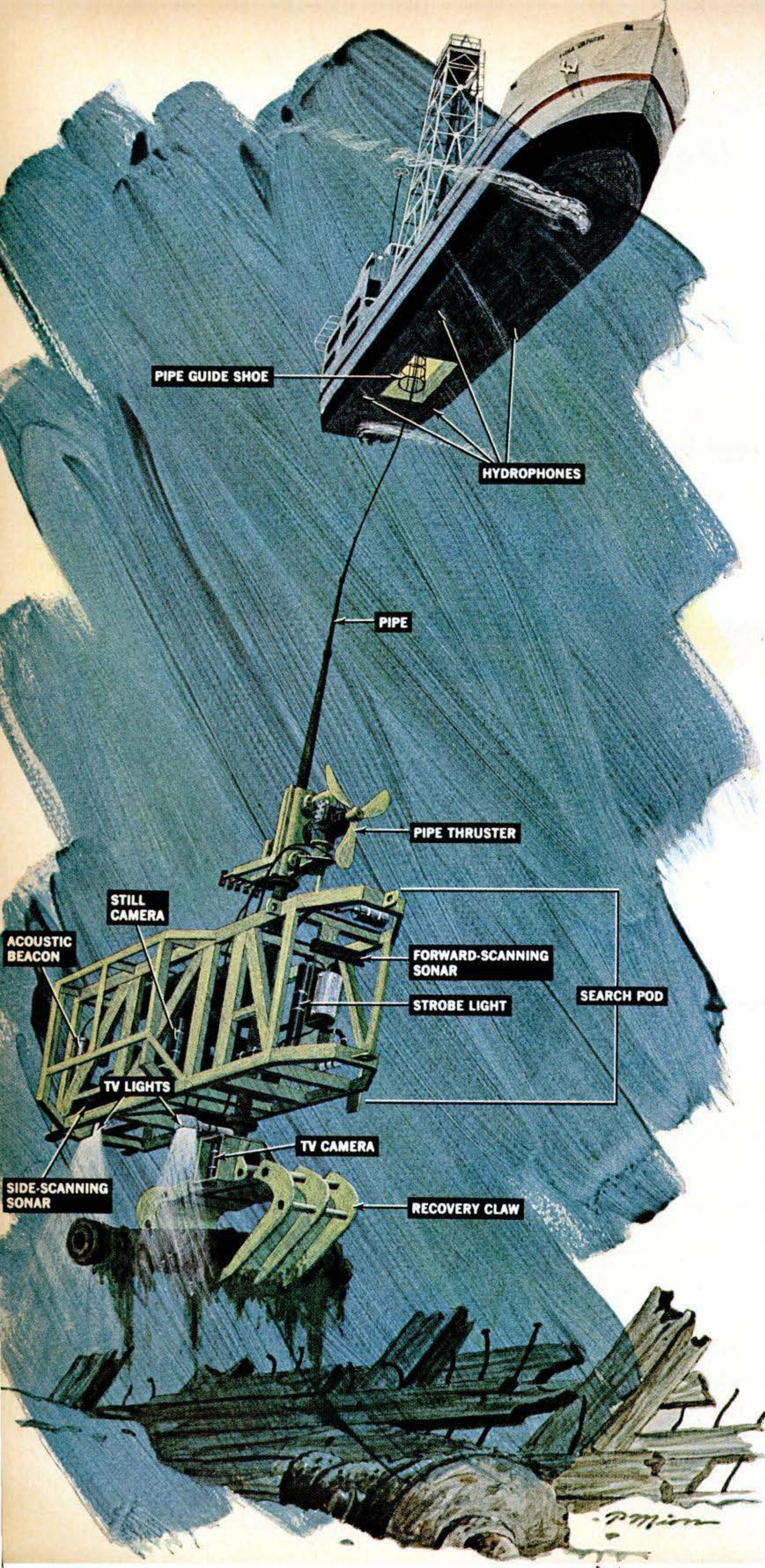
Most such missions require the coordinated labors of complex, expensive, and balky equipment, including, besides surface ships, manned submersibles, remote-controlled underwater manipulators, and towed devices containing detectors such as sonar, TV and still cameras, and magnetometers.

Now there is a remarkable new ship that integrates all of the search and recovery functions in one glittering, all-aluminum package. The Alcoa Seaprobe can recover 200-ton payloads from 6,000 feet below the surface of the water. And there's a big plus: It will also search, core, drill, and sample the ocean bottom in water depths to 18,000 feet, making it a powerful scientific research tool in the assault on "inner space."

Here are some of the engineering features that combine to make this do-everything ship the most advanced oceanographic vessel afloat:

- The 243-foot ship is constructed completely of a new aluminum alloy with high resistance to sea-water corrosion. The Seaprobe is owned and operated by Ocean Search, Inc., a subsidiary of Aluminum Company of America, and one of Alcoa's objectives was to prove that a large, all-aluminum ship was practical to build.

- The Seaprobe can hover above a given spot on the ocean floor with almost the precise control of a helicopter. It can maintain its heading regardless of sea conditions, move through the water sideways at any angle, and spin around in a circle her



SEAPROBE —

New Do-Everything Research Ship

own length. Precise dynamic positioning is made possible by the two Voith-Schneider cycloidal propulsion units, one forward and one aft, each with its own diesel-electric drive system. The cycloidal units also provide go-power for normal cruising—at about 10 knots. The ship's position can be controlled both from the pilot house and from an operations center whose TV screens display everything that's happening on the bottom. To get an accurate fix on the desired spot on the bottom, the ship's hydrophones pick up signals beeped out by acoustic beacons. And the ship can navigate ultraprecisely with radar, shore-based radio location, and worldwide satellite systems.

● The business end of the Seaprobe's engineering comes at the bottom of a string of steel drilling pipes—60-foot lengths threaded together to reach the desired depth. The string is semirigid. It's stiff enough so that the

equipment at its end can be maneuvered horizontally by a thruster powered by water pumped down through the pipe. This gives accurate positioning of sensor packages, recovery claws, or boring tools. Yet the string "gives" enough so it won't snap even when the ship is steaming forward at four knots. The 4½-inch pipe's tensile strength, matched to the heavy-duty draw works and 132-foot derrick, enable the Seaprobe to lift up to 200 tons from 6,000 feet.

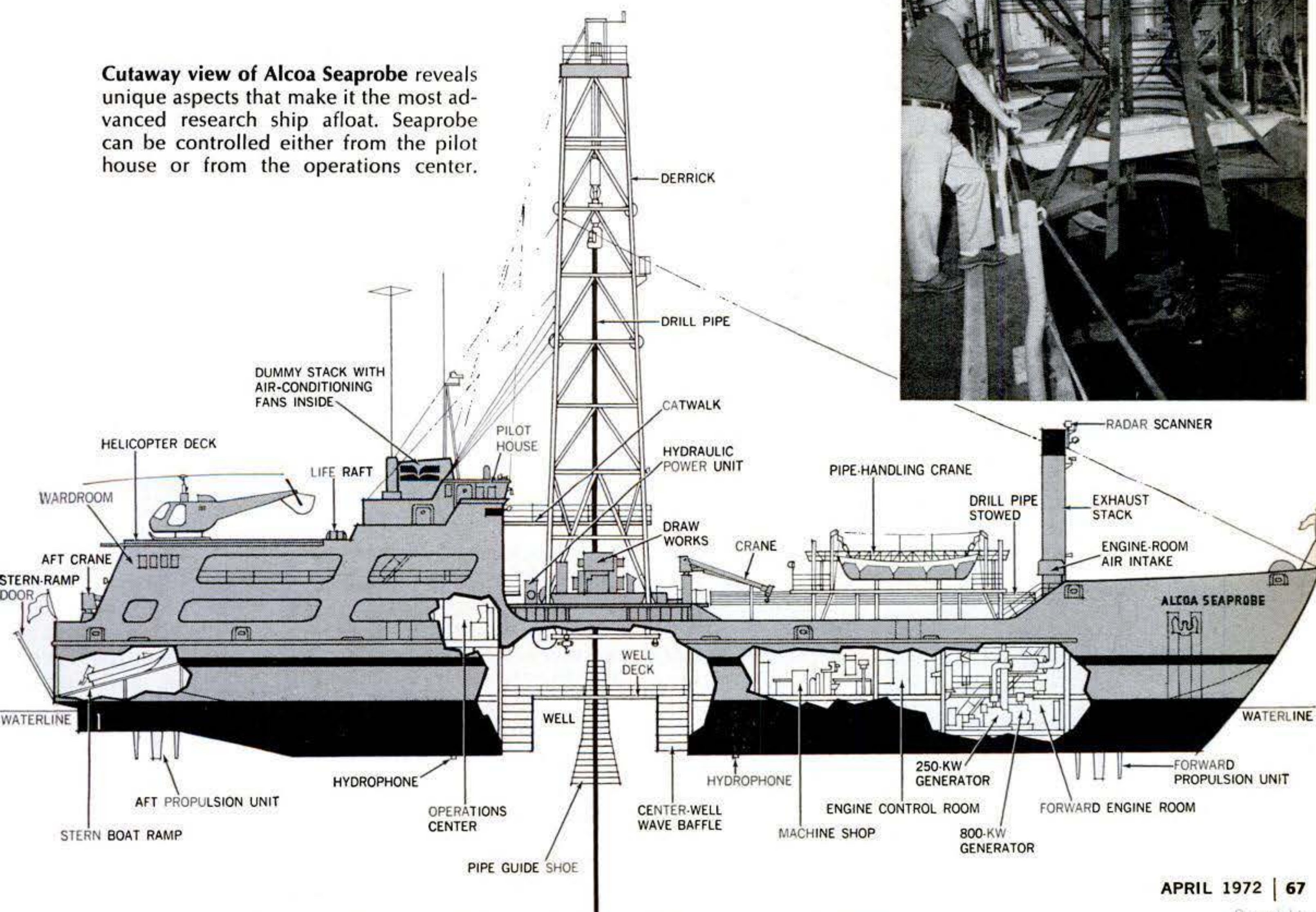
● A large (12-by-36-foot) center well directly beneath the derrick pierces right through the Seaprobe's hull. This allows large, multi-ton objects to be lifted straight into the ship and then be stowed safely in the 50-by-60-foot well deck working space. In fact, there are plans to try launching and retrieving the Johnson-Sea-Link, a research submersible ["See-All-Around Bubble Sub," PS, Sept. '71], through the Seaprobe's well. **PS**



Cycloidal propeller units (above), installed fore and aft, provide power for ocean transits and dynamic positioning. Pipe guide shoe (below) centers pipe in well.



Cutaway view of Alcoa Seaprobe reveals unique aspects that make it the most advanced research ship afloat. Seaprobe can be controlled either from the pilot house or from the operations center.



How you'll fly at almost the speed of sound in NASA's New Mach 1 Airliner



A craft with a radical new wing and a striking wasp waist will give you a ride 100 miles an hour faster than any passenger plane you can board today

By **DR. WERNHER von BRAUN**

NASA Deputy Associate Administrator
PS Consulting Editor on Space

In the late Seventies you'll ride an airliner of a new breed through the skies.

It will fly you about 100 miles an hour faster than today's passenger planes. It will offer you a smoother and quieter ride. On top of these advantages, your fare should be reasonable, because the new craft will be more economical to operate than any airliner in use today.

Good-neighborly features of the advanced airplane will appeal to others besides passengers and operators. Its engines will be smokeless. Outside, as well as in, its sound will be hushed.

NASA, which has pioneered this radical airliner, calls it the Advanced Technology Transport—ATT for short. It also goes by the name of

the Mach 1 airliner, because it will cruise at almost Mach 1—the speed of sound or about 660 mph, at cruising altitudes of 35,000 to 45,000 feet.

The Advanced Technology Transport will be "boomless." Its speed will not quite suffice to cause the objectionable sonic boom that supersonic aircraft create as they pass through the speed of sound. But it will far outpace today's airliners. The Boeing 707, for example, lumbers along at Mach 0.84—about 550 mph in layman's language. ATTs will speed as fast as Mach 0.98, or about 650 mph.

A whole family of ATTs, from 200-passenger airliners of transcontinental range up to 400-passenger transocean versions, is foreshadowed in current studies by NASA and by leading airplane and engine builders under NASA contract. At Mach 0.98 they will clip nearly an hour from a New York-to-San Francisco flight; up to two hours from an ocean crossing.

Higher speed without using more fuel, giving the ATT the economy of more miles per gallon of fuel, comes from two major breakthroughs:

The new supercritical wing. In July 1965, a confidential report announced the discovery of a wonder-working new wing shape, called the "supercritical wing," by Dr. Richard T. Whitcomb of NASA's Langley Research Center.

As a conventional airplane wing approaches the speed of sound, the airflow past its curved upper surface locally becomes supersonic, and a



Conspicuous wasp waist, new to passenger



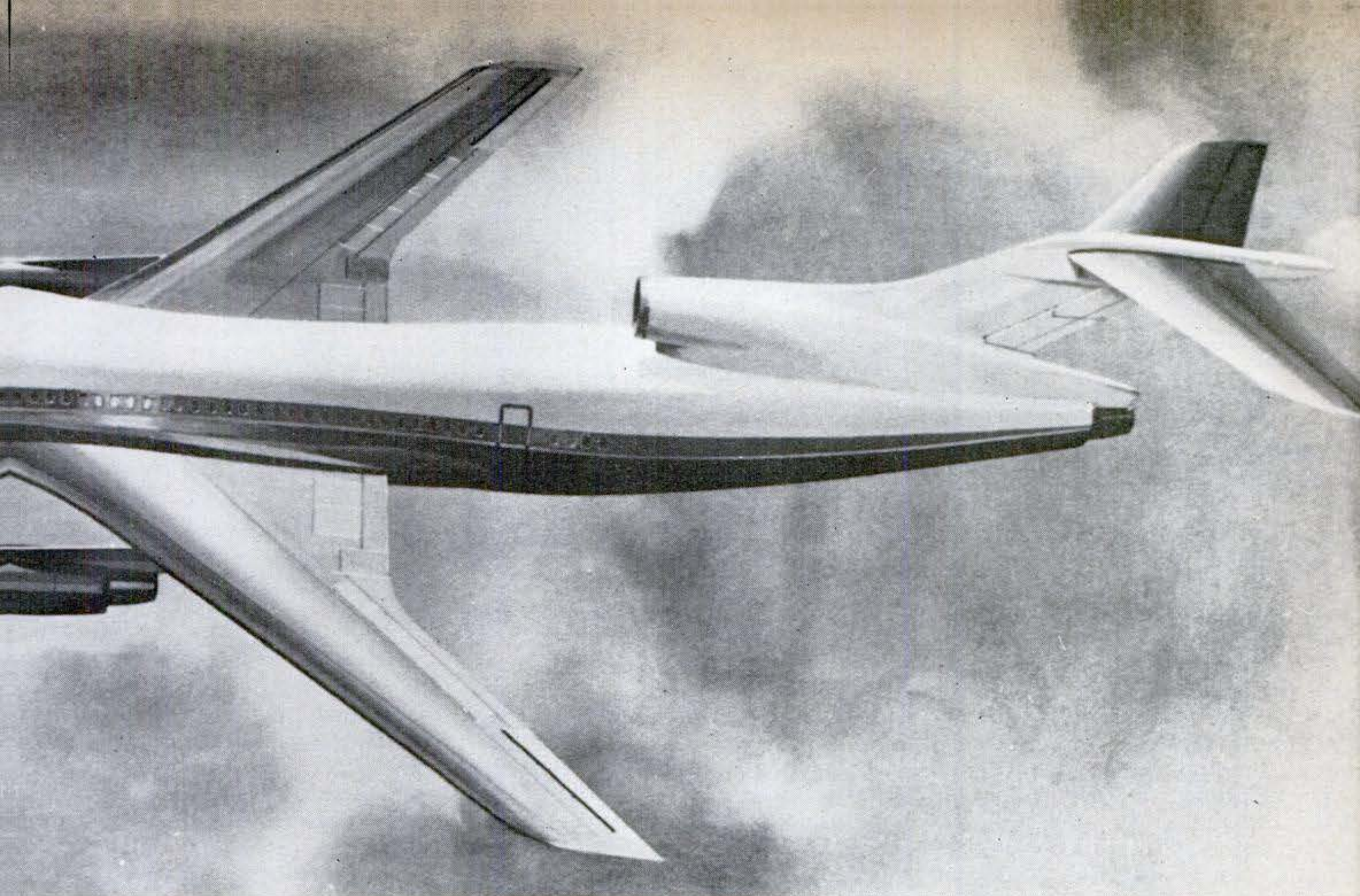
Projected family of Mach 1 airliners may include 400-passenger transocean craft, ex-

shock wave begins to develop there. Beyond this "critical" point, as it is called, there is a precipitous rise in air drag and the engine power required to overcome it; moreover, buffeting fatigues structures and causes discomfort for passengers.

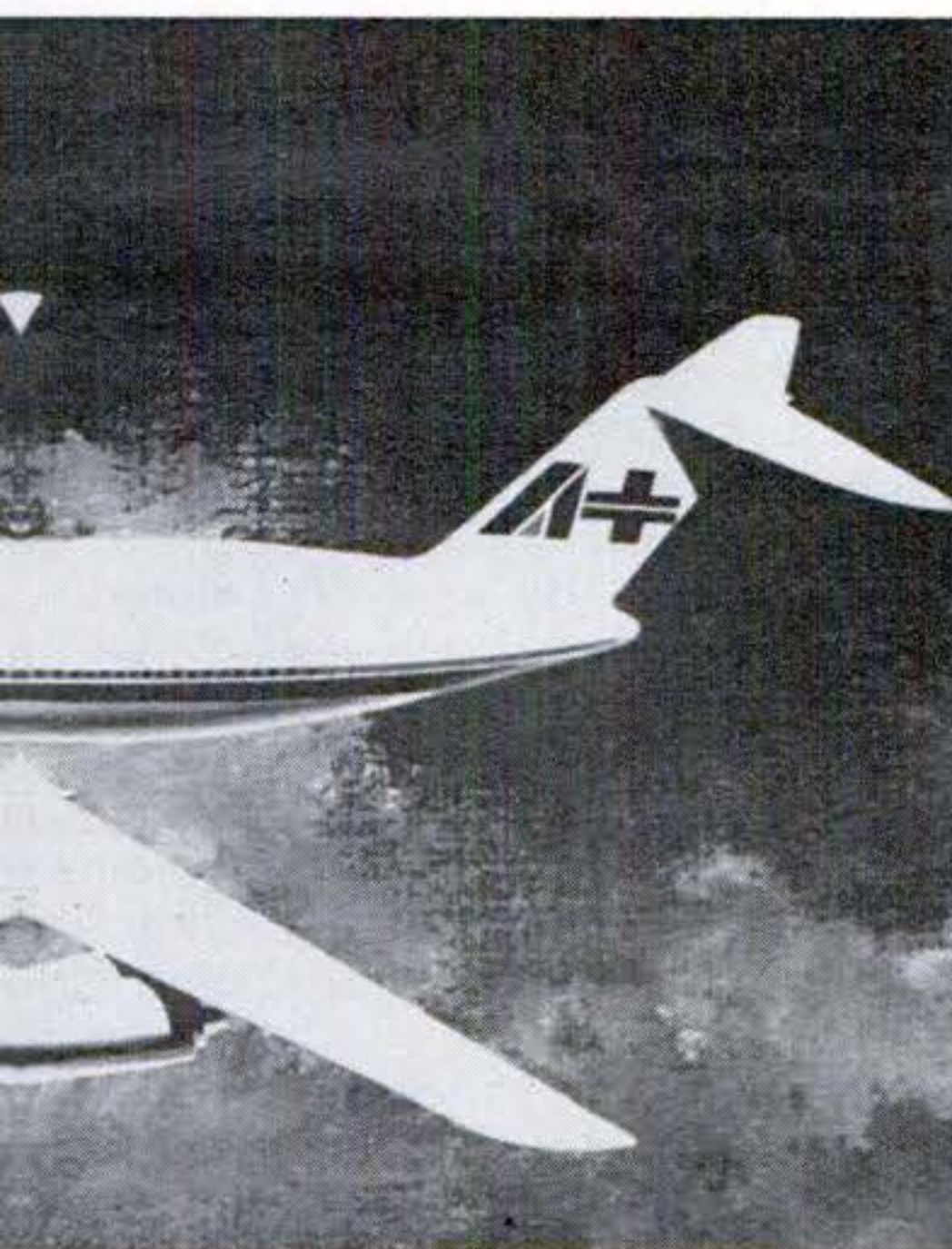
The novel flat-top shape of the NASA supercritical wing delays the onset of these effects. Wind-tunnel tests, between 1965 and 1970, indicated that it promised speeds exceed-



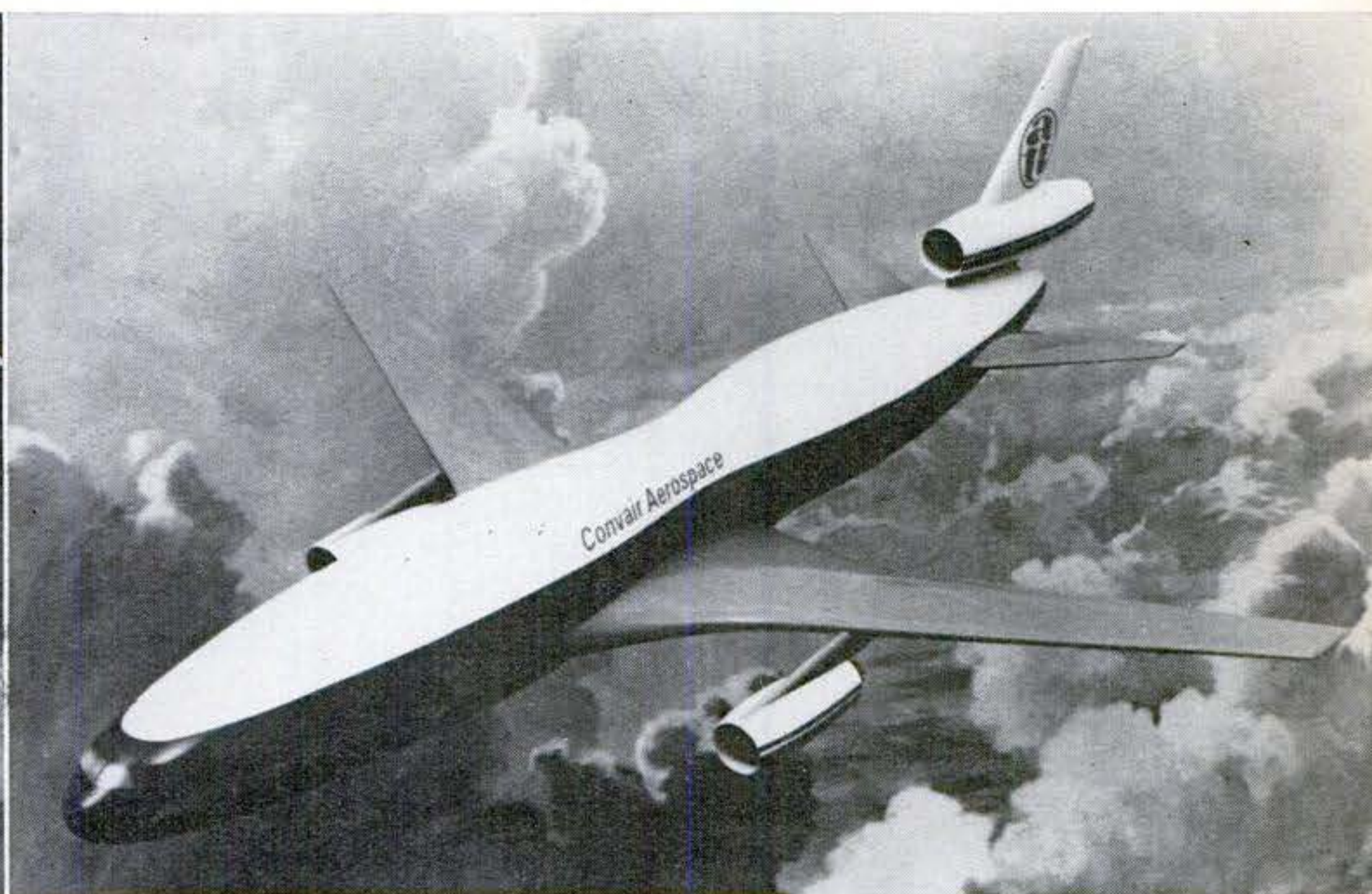
Dr. Richard T. Whitcomb, who pioneered supercritical wing and wasp-waist concepts, views model of new wing on an F-8.



... aircraft, is striking feature of NASA's Mach 1 plane. The 200-passenger transcontinental version above is envisioned by Boeing.



...emplified by this Lockheed concept, with a range of more than 5,700 statute miles.



Alternative Mach 1 airliner is the design of General Dynamics' Convair Division: a 200-

passenger craft with coast-to-coast range of more than 3,400 miles.

ing Mach 0.95 before the drag rise and buffeting began.

Finally the wraps came off, and in early 1971, the new wing's predicted performance was verified in flight tests with a modified F-8 airplane.

To build an airliner that could take full advantage of the new wing, another major discovery—already contributed by the same researcher, Dr. Whitcomb—had to be applied:

The wasp waist. Most conspicuous

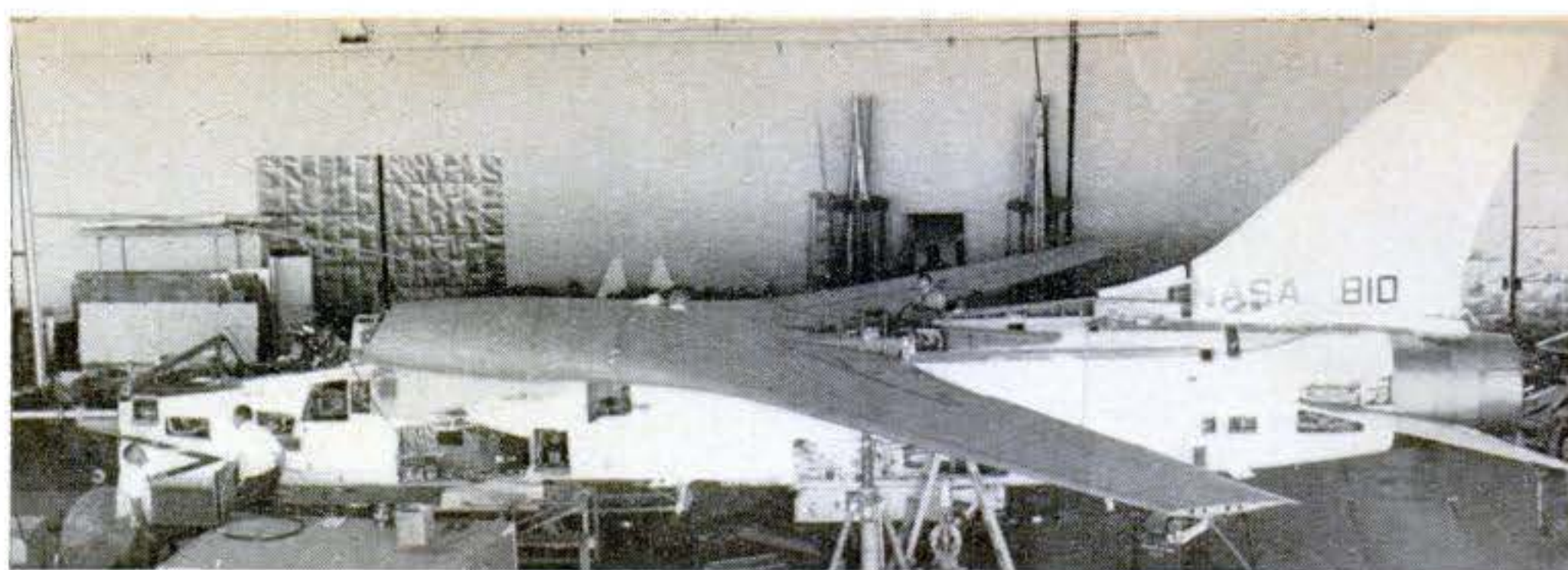
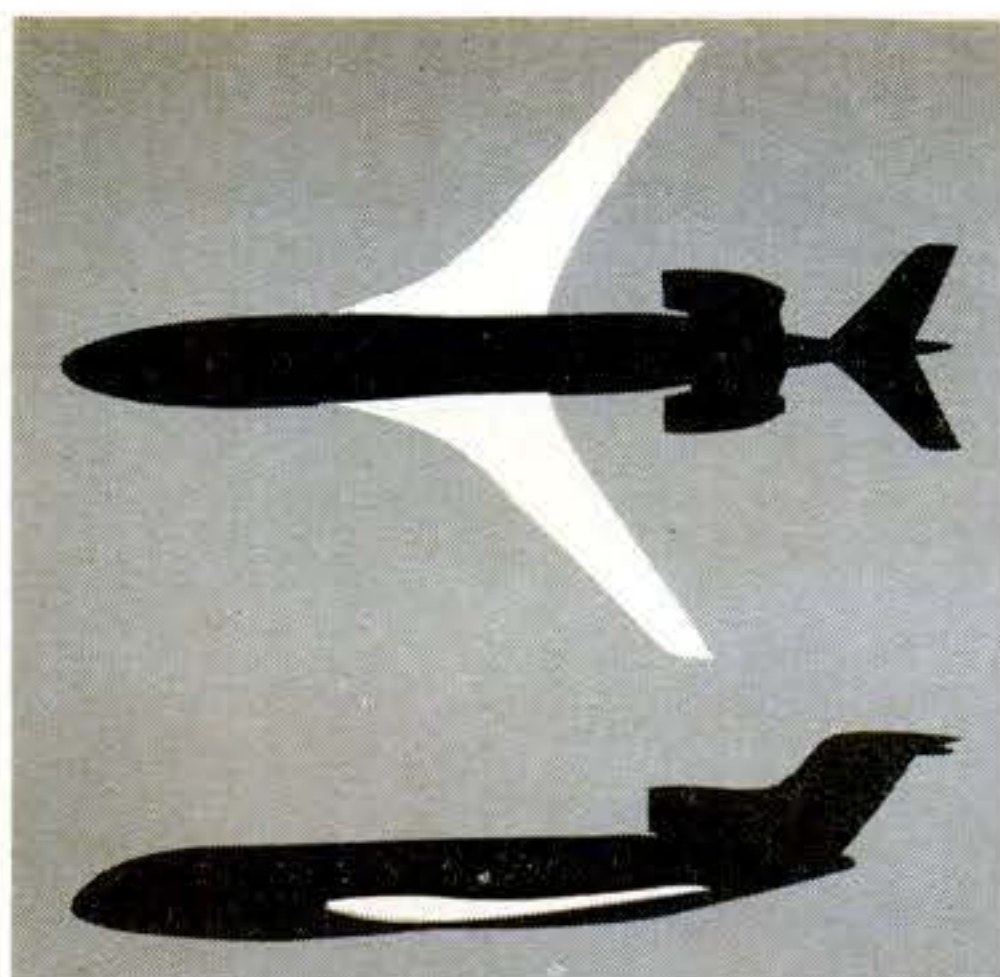
innovation of the ATT will be its other breakthrough, the wasp-waist or "Coke-bottle" shape of its fuselage. Like the newer supercritical wing, the wasp waist plays a key role in reducing air drag.

The pinched-in shape stems from a drag-reducing Area Rule that made big aeronautical news when its discovery by Whitcomb was released from military secrecy in 1955. In its simplest or "transonic" original ver-

sion, the Area Rule works like this:

Take one of our present-day airliners such as the Boeing 707. Determine its drag-producing areas from nose to tail by taking slices, salami fashion, at one-foot intervals. You'll find the cross-sectional area increases smoothly up to where you get to the full diameter of the cylindrical body. Here it levels off.

But as your wandering salami knife strikes the engine intakes and the



New supercritical wing, an innovation to be incorporated in the coming Mach 1 airliner, is shown above being installed for flight trials on a modified Navy F-8 jet plane at

NASA's Flight Research Center, Edwards, Calif. Drawings at left reveal novel shape of the drag-reducing "flat-top" wing as viewed from top and side.

wing root, the drag-producing cross section suddenly shoots up again. On a graph of step-by-step areas, it forms an ugly bump. This bump is by no means desirable for a Mach 0.84 plane like the Boeing 707. For a Mach 0.98 transport it would be disastrous. To keep the drag at that speed within acceptable limits, that bump has to be reduced or eliminated.

The solution is to tighten the belt of the airplane's body, enough to offset the excess cross-sectional area of wings and engine nacelles. And what you get is the wasp waist.

The first wasp-waisted aircraft were Air Force and Navy fighters of 1954. The B-58 Hustler bomber of 1956 was another example. While many later supersonic aircraft look as if their designers had never heard of the innovation, the reason is simple:

Benefits of the original Area Rule's wasp-waist shape are limited to the transonic range of speed—about Mach 0.9 to Mach 1.2. For faster craft there now are more-complex "supersonic" forms of area-ruling, which do not lead to a prominent wasp waist, but to subtler refinements of shaping. The wasp waist, however, remains ideally advantageous for a plane that lingers

near Mach 1. The ATT, first passenger plane that just fits this description, will therefore have it.

This "waisting" raises another question. A very convenient way of adapting airliners of the same generic breed to airlines' widely differing requirements is the method called *stretching*.

By adding constant-diameter body sections fore and aft of the wing, higher-capacity models of a current transport can be spun out of the original airplane with relative ease. We all have seen the stretched DC-8s and the stretched Boeing 727s.

The capability to stretch a basic airplane design will be as important for the breed of Mach 1 airliners as it is for today's birds. Obviously, with a carefully sculptured area-ruled Mach 1 transport, thorough wind-tunnel studies must precede and support design stretchouts to avoid unacceptable bumps.

Showcase of advanced features. The ATT aims at much more than higher cruising speed. It will be a showcase of the most advanced technology of all kinds that can be crammed into an airplane. There are a number of innovations it will incorporate.

- Engines will not smoke at any power setting. Carbon monoxide and unburned hydrocarbons in the exhaust will be greatly reduced, diminishing air pollution.

- Noise will be lowered far below stringent Federal standards for new aircraft, without a noticeable effect on operating cost. Further dramatic quieting, by improved engine design and acoustic treatment, looks possible with only a modest increase in operating cost.

In a world extremely sensitive to the words "pollution" and "environment," these competitive advantages alone may often be decisive.

- Composite materials—like fiberglass in principle, but using novel recipes such as boron fibers embedded in a plastic matrix—will find extensive use and will reduce structural weight by 10 percent or more.

- A technique called "fly-by-wire," which has become a must in manned space flight, will make airplane controls responsive to an ATT pilot's gentle touch. By way of a computer, his pedal and yoke deflections go to power-steering actuators that move the airplane's control surfaces. The same computer accepts additional command signals from instruments such as an angle-of-attack meter, an airspeed indicator, an altimeter, and an accelerometer.

Extensive flight testing has shown that the more-elastic response of fly-by-wire to gusts and turbulence will offer you a smoother ride. It also extends the "fatigue life," and thus the revenue-producing life, of the entire airplane structure.

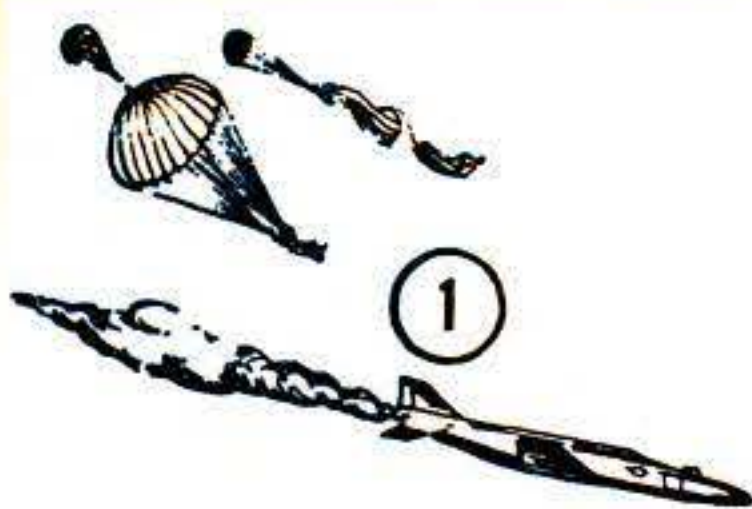
- At terminal airports, steep climb-outs and landing approaches will greatly reduce the ground area affected by low overflights—a desirable goal, even with drastically reduced engine noise, in densely populated localities. Today an airplane making an instrument landing, under conditions of low ceiling and limited horizontal visibility, must follow the shallow 2½-degree glide slope provided by standard sys-

[\[Continued on page 132\]](#)

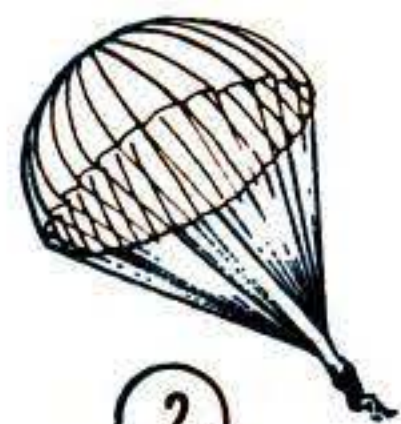


Airborne on new wing, F-8 confirms promise it showed in wind-tunnel tests. For more

experiments, addition of side fairings will give test plane a wasp waist.



1



2

Pilot is ejected from disabled jet (1) and parachute opens. Seat falls away during this part of sequence.

Pilot is suspended in the usual manner (2). Terrain and location permitting, he decides to deploy Ballute.

Drogue chute pulls cover from Ballute housed in webbing at top of chute (3).



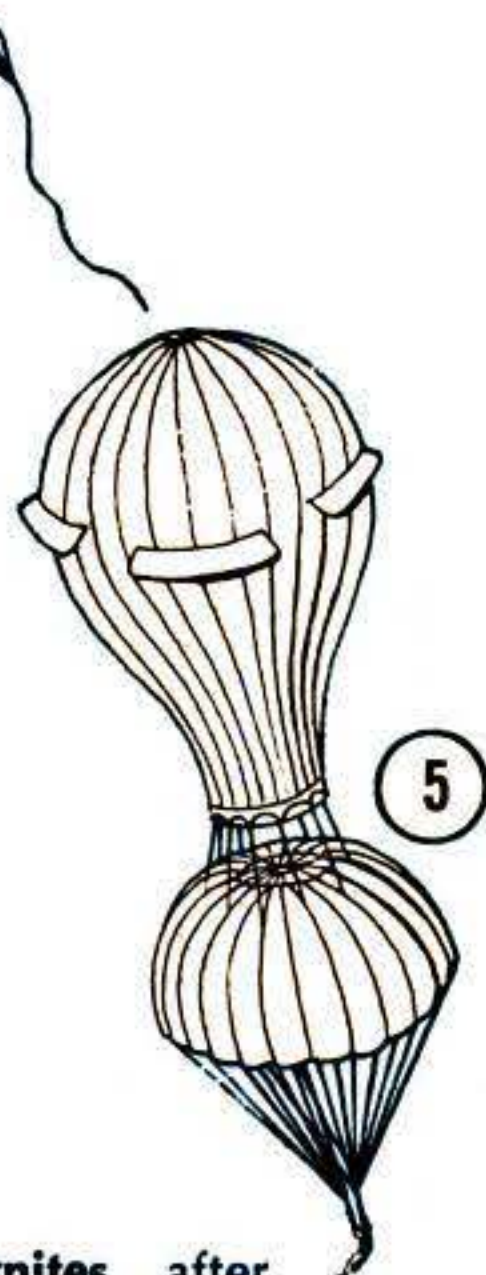
3

Ballute inflates (4) as air is forced through its throat during parachute's descent. Inflation time: about half a minute. Altitude loss: ± 800 feet.



4

Burner ignites after Ballute is 40-70 percent full (5). Ballute can begin ascent one minute after ignition.



5

Waiting aerial pickup, system is holding steady altitude (6). Pilot can still go up or down by controlling fuel flow.



6

Pilot is rescued by retrieval plane (7), or breaks away from Ballute and parachutes down.



7

Balloon + Chute = Ballute

By DOUGLAS GARR

Midair rescue is now possible—pilot can hover or rise

A fighter pilot who bails out over enemy territory is in trouble—even after his parachute opens. In Vietnam, one out of two become POWs. Fred Nebiker of Goodyear Aero-

space Corp. has invented a system to give the pilot of a disabled aircraft a better chance. He calls it PARD—for Pilot Airborne Recovery Device.

PARD weds a modified military parachute to a hot-air balloon. As the drawing above illustrates, the pilot can bail out and stay aloft. Hovering by balloon power, he can:

- Stay up for 30 minutes (his fuel

runs out then), hoping to drift away from enemy ground fire before he has to descend.

- Send out a signal to a rescue plane nearby. A pickup plane can snag him and haul him inside, or tow him to a friendly area where he can descend by parachute.

- Descend and land with the balloon immediately or release the balloon and use the chute.

Heart of the PARD system is a high-capacity butane burner, a fuel tank with 14½ pounds of butane, and the Ballute—a 37-foot-diameter balloon that holds 22,450 cubic feet of air.

The parachute is a standard military model with one modification: a special six-foot hole in the top, where the Ballute and burner are housed in a mesh of nylon lines. Air also goes through this hole during descent to inflate the Ballute before the burner goes on.

The fuel tank stays on the pilot's back. Butane feeds through a hose on one of the chute's lines.

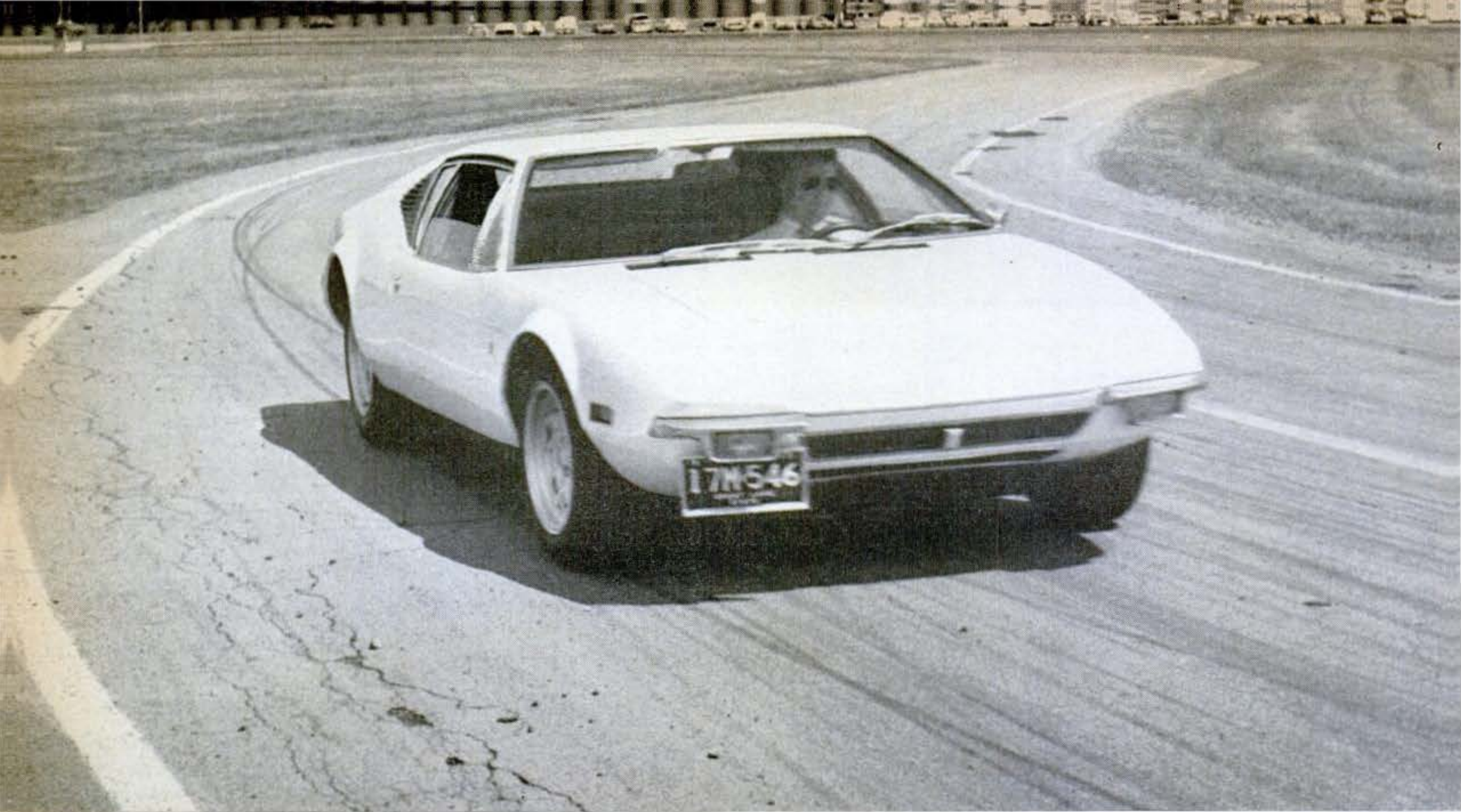
Nebiker, who patented the device in 1968, has developed working systems under Air Force contracts. No human tester has jumped with PARD yet—data is gathered with Oscar, a test dummy, in the hot seat.



Ballute is housed behind pilot. The 65-lb. rig fits ejection seat of F4 Phantom.



Ballute maintains altitude (buoyancy). Chute, hanging limply, can still be used.



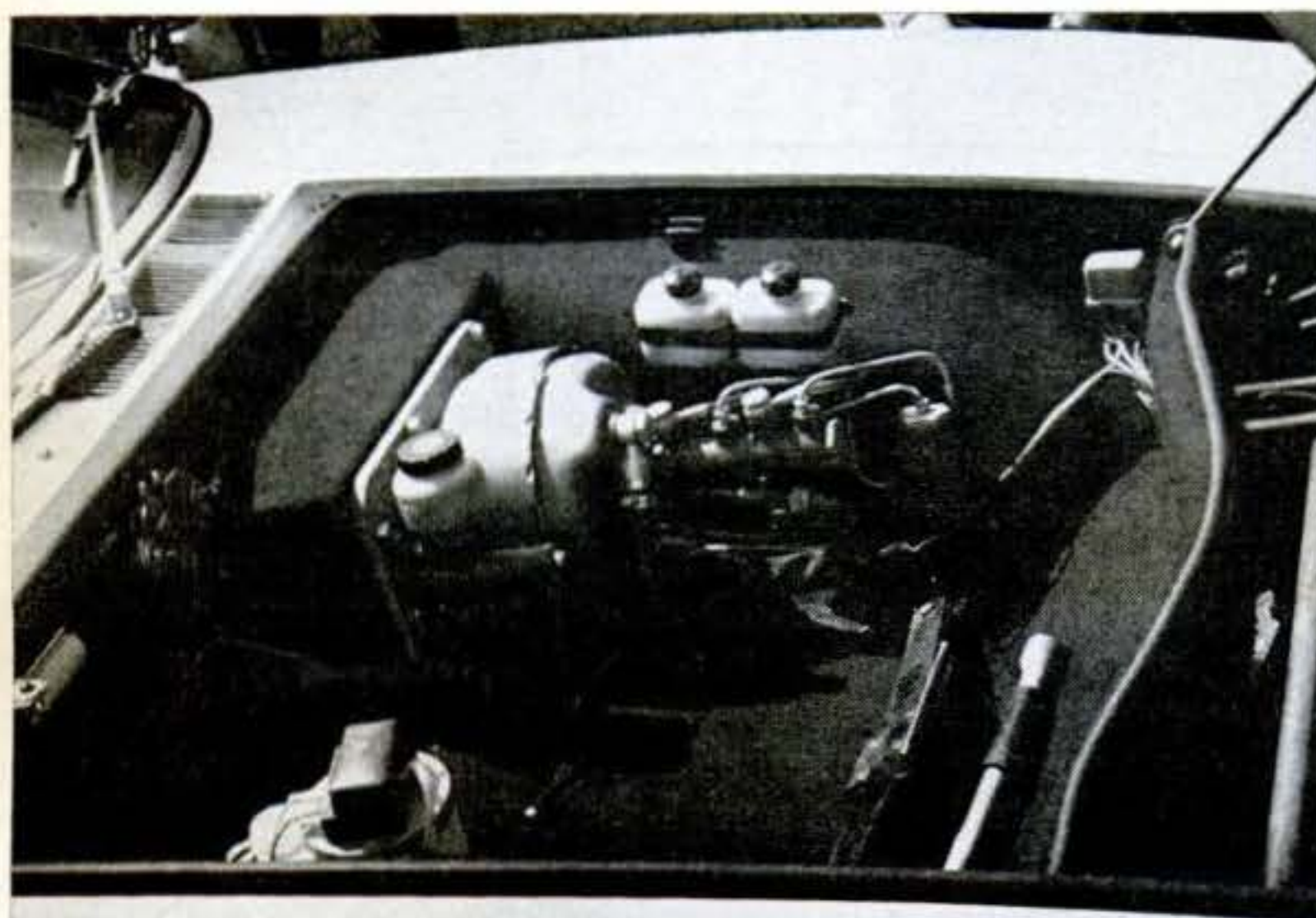
The Pantera corners as flat as a road grader, with no body roll, even when cornering forces almost lift the inside front tire.



Racing-style driving position with straight arms comes naturally in the Pantera. Backrest reclines, and seat gives very good lateral support for driver's back and thighs.



Tach and speedometer are close to driver's line of vision on either side of small-diameter padded-rim steering wheel. Other gauges are at the head of the console.



Small "trunk" ahead of windshield holds jack and tools, washer reservoir, brake booster, master cylinder, brake-fluid reservoirs.



Rear view shows the Pantera's extremely low build, fat tires, restricted visibility, and minimal bumper protection.

Ford's Dream Car You Can Buy—Now!

An ultrahigh-performance machine from Italy, using a Ford V8, can be yours for around \$10,000

By JAN P. NORBYE/PS Automotive Editor and JIM DUNNE/PS Detroit Editor

The first thing you've got to understand about the Pantera is why we're calling it a "dream car." It's not one of those models with fancy bodywork and standard running gear that were called dream cars, back in the '50s. The Pantera has very thorough engineering behind it, as well as trendy styling.

But it is just the kind of car you dream about—a car you may never buy but that you would just love to drive and drive and really get to use all its performance.

Okay, now you can buy it. With its emission-controlled Ford "Cleveland" V8 and all required safety features, it is as legal as a Checker Cab. It won't meet the '73 bumper standards, but Ford has applied for an exemption (since production will be limited).

Available from Lincoln-Mercury dealers, the Pantera (Italian for Panther) is a product of De Tomaso in Modena. Alejandro De Tomaso came to Italy from his native Argentina back in the '50s and became a racing driver. Later he started to build cars. He has been tied to Ford since 1970. The all-steel unit-construction body is designed and manufactured by

Ghia in Torino (also linked with Ford now).

We went to Ford's proving grounds to drive the Pantera—a great experience. Performance is in the Corvette class, but it's a very different kind of car. Both are strictly two-seaters, but the Pantera chassis is built like a racing car, with midships engine, and there's no automatic transmission option.

Car for tough drivers. Personally, we loved the five-speed ZF built in Germany, with its tight gate and slick movements. Power steering, popular on Corvettes, is not available on the Pantera. It doesn't make any compromises. It's a car for tough drivers. If you want to use its muscles, you've also got to have some of your own. Plus a cool head. Oh yes, air-conditioning is available, and we think it's a must.

In short, the Pantera is the nearest thing to an all-out racing car that you can legally drive on the highway. Driving it on Ford's test track was a big thrill. There was no other traffic, so we could really try our darnedest. On the very first lap, it was obvious how beautifully balanced the Pantera is. With a midships engine, you



Norbye (left) and Dunne discuss the car's characteristics after their test drive.

might expect less stability and less-consistent handling characteristics.

But the Pantera was flawless. If you go too fast into a turn, it understeers—actually understeers. Back off, rub off some speed, and you're ready for the next curve. There's no body roll at all, no matter what you do. If you have the skill and nerve, you can drive it like a real racer, steering as much with your foot as with your hands. The tail end comes out a bit with full acceleration out of a turn, and you can hold the car in its drift until the roadway straightens out completely.

On the road, we found the Pantera tractable and well behaved, comfortable and luxurious in the GT idiom. It's an easy car to fall in love with. And if you do, you'll soon find yourself driving it everywhere. With its Ford engine, you know it's going to be reliable. And you know there will be parts and service. There's only one possible snag: Have you got the bread? **PS**

Facts on the Pantera

DIMENSIONS (inches)

Wheelbase	98.4
Front track	57.0
Rear track	58.0
Length	167.0
Width	67.0
Height	43.4

SPECIFICATIONS

Engine type	OHV V8
Displacement	351 cu. in.
Carburetion	One 4-bbl.
Compression ratio	11.0:1
Net hp @ rpm	273 @ 5,400
Torque @ rpm	380 @ 3,400
Transmission	5-speed man.
Final drive ratio	4.22:1
Tires	Pirelli Cinturato
Front-tire size	185SR-70
Rear-tire size	215SR-70
Steering	Rack & pinion
Turns, lock to lock	3 1/4
Brakes	4-wheel disk

TEST RESULTS

Acceleration 0-60 mph	6.0 sec.
0-80 mph	9.1 sec.
0-100 mph	14.0 sec.
0-125 mph	27.0 sec.
25-70 mph 3rd	7.5 sec.
Top speed (5,400 rpm in 5th)	130 mph



Purposeful look emphasizes the performance of the car; styling gimmicks have been

completely avoided, and thorough engineering built in. It's a modern classic!

Those New TV and Hi-Fi Gadgets

There's a wide variety to choose from. To our surprise, many proved to be helpful

By RONALD M. BENREY

Once you've plunked down the purchase price of a stereo rig or a TV set, you automatically become eligible to spend a lot more money—for an almost endless parade of accessories. What are, and how good are, the latest stereo and TV gadgets? Here's what I found:

First, that the emphasis has shifted from new products designed for records and record players to accessories for use with cassettes, cartridges, and their players. Similarly, in TV gadgetry, the trend is toward products designed for color TV.

After trying out many of these new devices, I came to the surprising conclusion that most of today's gadgets make sense. Sure, a few are priced way out of line, and a few are simply silly gimmicks, but for the most part the accessories are worthwhile additions that do their jobs well.

Phono-stylus timer. *Park PNT1*, \$5.25. Even a diamond stylus wears out with use, and so a timer that keeps track of stylus usage is an excellent

idea; it signals you to inspect stylus condition before a worn point does damage to your records.

This one is a particularly clever timing device. It actually uses the rotating turntable as a "clock motor." An internal magnet in the timer senses a small strip of magnetic material placed on the turntable's rim. Each time the turntable revolves, the magnetic strip repels the timer's magnet and advances the timer one notch. An easy-to-read scale displays total time up to 250 hours; a few twirls of a knob reset the timer to zero. The timer is calibrated for use with a turntable spinning at $33\frac{1}{3}$ rpm.

Stereo-headphone control box. *Lafayette 99-00242*, \$4.95. This lets you adjust individual left and right ear-piece volume for your stereo headphones from your chair. And a three-position slide switch lets you connect your phones to either the left or right channel if you wish (but why on earth would you wish?). For my money, this is a useless device. Normally the only time I find it necessary to readjust volume is when I tune to a new FM station. At that point, I'm standing in front of my amplifier anyway.

Hi-Fi Sentinel. *Realistic 42-2932*, \$5.95. Here is a remarkably overpriced item—little more than a pair of AC sockets and a switch mounted in a metal box.

You connect the gadget to the rec-

ord player with a socket and plug in series with the existing socket/plug pair underneath the player. Then you plug your amplifier into one of the outlets, a low-wattage lamp into the other, and when the changer stops, the amplifier and light go off as well. My opinion: The kind of audio systems needing auto turnoff—simple phonographs—probably already have it.

Test records and tapes. *Audiotex 30-200 record*, \$4.98. *Realistic 50-1001 record*, \$2.49. *Audiotex 30-212 cassette test tape*, \$5.60. *Audiotex 30-213 cartridge test tape*, \$7.95. *Audiotex 30-214 reel test tape*, \$6.80. I found the test records to be much more useful than the test tapes.

The records help you adjust your amp's stereo balance control; they test for speaker phasing, and identify left and right channels; they point up turntable rumble; and they test for a faulty phono cartridge. Both records come with detailed instruction booklets.

The test tapes, however, contain a series of tones and test signals that are generally meaningless unless you own additional testing gear, or unless you are prepared to make finicky tape-head position adjustment. But the barely adequate instructions caution that "it is advisable to have a serviceman make these adjustments".

Remote wireless stereo speaker system. "Speaker of the House," Concept



For hi-fi, gadgetry includes: test records (*Audiotex 30-200* and *Realistic 50-1001*) for complete system checkout, headphone-control box (*Lafayette 99-00242*) for remote volume and switching, phono-stylus timer (*Park PNT1*) for determining needle wear, and HiFi Sentinel (*Realistic 42-2932*) for auto amplifier turnoff.

Remote stereo speaker system, "Speaker of the House," is by Concept Plus. Connect encoder box (above speaker) to left and right speaker terminals of your amplifier, and it transmits each channel separately throughout your home over the house wiring. Each speaker has volume, bass, and treble controls.

—Worthwhile or Worthless?

Plus, \$150. Here's an old idea updated. These two stereo speakers operate wireless from any room in your house. Connect the speaker-output terminals of your hi-fi to the encoder box (atop left speaker) and it will transmit two channels of stereo through your house wiring to the respective left or right speaker. Each speaker contains its own decoder and amplifier. Unlike earlier conventional tries, this system uses frequency modulation rather than amplitude modulation. Result: sounds surprisingly good. Its true asset to me was not the fact that I didn't have to wire my house for remote speakers, but rather that I could put the speakers anywhere I happened to be at the time. They got a true workout in the garage, patio, and backyard.

When a color picture tube ages, one or more of the three cathode assemblies loses the ability to produce a dense electron beam. The usual symptom is an uncorrectable overall color tint due to an incorrect balance among the glowing red, blue, and green phosphor dots on the screen.

Color picture-tube brightener. *Archer 15-642, \$6.95.* This device attempts to solve the problem by raising the picture tube's filament voltage (the same technique used by black-and-white TV boosters). This makes all three cathodes run hotter, increasing emissivity of the failing cathode back to normal. Back-of-the-set controls are used to compensate for the boosted emissivity of the normal cathode. The fix is temporary at best, and there's a rub: The cathode balance adjustments are likely to need almost continuous touching up to compensate for further cathode aging.

One-gun booster. *Workman W6-1, \$8.50.* Using a different approach, it connects the bad cathode screen grid and signal grid, applying a higher-than-normal voltage to the signal grid and boosting cathode emission at the cost of picture quality.

Without doubt this is the most overpriced gadget in the group—it's nothing more than a variable resistor and a couple of resistors wired into a plastic can. And I'd check with my set maker or serviceman about the possibility of damage to the set's color-output stages before I installed the booster. Generally, if my picture tube were failing, I'd forget about a booster and apply the money toward a new picture tube.



For TV, add-ons shown are: (at bottom) antenna rotor (Cornell-Dubilier AR-33), antenna line filter (Audiotex 30-6100), speaker-control box (Audiotex 30-6008), one-gun

booster (Workman W6-1); (top) tube brightener (Archer 15-642), ghost eliminator (Archer 15-1114), power-line filter (Archer 15-1106), TV-tube protector (Archer 15-584).

TV tube protector. *Archer 15-584, \$1.99.* You may already have one of these built into your TV. If not, it's a worthwhile accessory. Inside is a special resistor that is temperature-sensitive; the warmer it gets, the greater the current that flows through it. The device prolongs the life of your tubes by eliminating damaging current surges when you first turn on the TV. When you flip the switch, the resistor is cold, so a smaller current flows into the set. After about 30 seconds, it warms up, and normal current is allowed to flow.

Interference filters. I tested two: a power-line filter, *Archer 15-1106, \$3.99*, and an antenna-line filter, *Audiotex 30-6100, \$2.25*. After using an idling auto engine, a CB transceiver, a power-tool speed control, and a variety of power tools to generate typ-

ical power-line and TV-signal interference, I found that these filters did a fair job. They eliminated the "typical" interference I generated, although when I tried hard, I could produce power-line interference that got through the filter. My suggestion: If interference is a problem, try a filter attachment. The low price makes it a worthwhile gamble.

TV speaker remote-control box. *Audiotex 30-6008, \$9.95.* This gadget gives you a little loudspeaker, a volume control, and a selector switch at the end of a long cord. With it you can turn off your TV's main speaker and listen through the little speaker. The volume control adjusts the remote speaker's sound output. It works, but I'm not sure what it's for.

Ghost eliminator. *Archer 15-1114,*

Continued

Some are priced out of line, and some are simply silly



For cartridge and cassette players (left to right, front to rear): cartridge test tape (Audiotex), cassette splicer (Robins), AC cartridge head demagnetizer (Audiotex),

auto version (Audiotex), reel test tape (Audiotex), cassette head cleaner (Audiotex), cassette test tape (Audiotex), log book (Robins), bulk tape eraser (Audiotex).

\$3.99. This baby just arrived from the land of wishful thinking. It connects between the antenna lead and your TV's antenna input terminals. Inside, a resistive attenuator reduces the signal strength of all incoming signals, on the theory that weak ghost signals will be weakened even more before they are fed to the set, and will end up too small to be annoying. In practice, however, the desired signal is simultaneously weakened.

Antenna rotor. *Cornell-Dubilier*, \$49.95. This item falls into the realm of interesting gadgetry because of the pushbutton switches on the front. It will operate as a regular rotor with a compass dial, but it also has an added pushbutton option. Each button is presettable to any antenna position. Once set, you can home in on your favorite channels by simply pushing the appropriate button. It's a little more expensive, but a lot less irritating. Worth the couple of extra bucks.

Harmful dirt is a fact of life on the head of any record or playback machine. Iron oxide and airborne dust clog the tape-head gap and act as an abrasive that wears at the precision surface. Periodic cleaning is a must.

Tape head cleaner. *Audiotex 30-614*, \$2.80. This is a clever gadget for cleaning tape-cassette record/playback heads. It's a tape cassette that

contains, instead of magnetic tape, a short length of stiff paper tape impregnated with a dry-cleaning compound. You put it into the cassette player, push the play button, and let the paper tape scrub the tape head, capstan, and pinch roller clean. After a few passes, however, the paper tape picked up enough dirt to look suspiciously like fine emery paper . . . so I recommend you discard the cassette after a dozen-or-so cleanings, to avoid the possibility of damage to the tape head.

The same sort of device is available to clean cartridge-player tape heads. Keep in mind, though, that the tape cleaners, although easier to use, do not do as thorough a job as liquid cleaners because they clean only one narrow path—the path threaded by the tape.

Bulk tape eraser. *Audiotex 31-40*, \$18.30. A good bulk tape eraser is about the only device that will restore a well-used cartridge, cassette, or reel of tape to noise-free, like-new condition. The eraser head on a recorder isn't powerful enough to do the job. If you frequently reuse magnetic tape, a bulk eraser is a good investment.

This cleverly designed unit can be used both as a hand-held model to clean cassettes and cartridges, or as a table-top device to erase reels. The gimmick is a folding spud that shifts up to hold tape reels, folds away for hand-held operation.

Then there's the problem of demagnetizing. As magnetic tape moves past the playback head, it slightly magnetizes the tape head, impressing a hissing noise on the tape that cannot be removed. Thus, it's good practice periodically to demagnetize the head of any tape machine.

Accessible cassette-player heads can be demagnetized by a conventional reel-to-reel recorder demagnetizer. Cartridge players, though, pose a difficult problem: The head is squirreled away deep in the mechanism.

Cartridge demagnetizer. *Audiotex 30-112-2*, \$11.95. This has an especially long snout to let its demagnetizer tip reach deep inside a cartridge player. It's used in the same way as conventional demagnetizers and does its job well.

Automobile cartridge-player demagnetizer. *Audiotex 30-142*, \$9.90. It's designed to work off the cigarette-lighter socket only. Although it works well, the purchase price is kind of steep for a device with no in-home application. It's not that difficult to run an extension cord out to your car and use a conventional AC-powered demagnetizer.

Cassette splicer. *Robins TS-115*, \$3.75. Even with this handy splicer, mending the hair-narrow tape in a cassette is tricky. But if a prized cassette has snapped, or you want to try your hand at editing a tape, it does a fairly good job of holding the tape in place. It comes with 25 transparent tape splices.

Cassette/cartridge log kit. *Robins TK-35*, \$3.75. If you're a nut for documentation, here's the perfect answer. It lets you identify up to 120 items in your tape collection with color-coded stick-on labels. A log book cracks the code and tells you what is where. However, keep in mind that you can probably duplicate the contents of the outfit at a stationery store for about \$1.50.

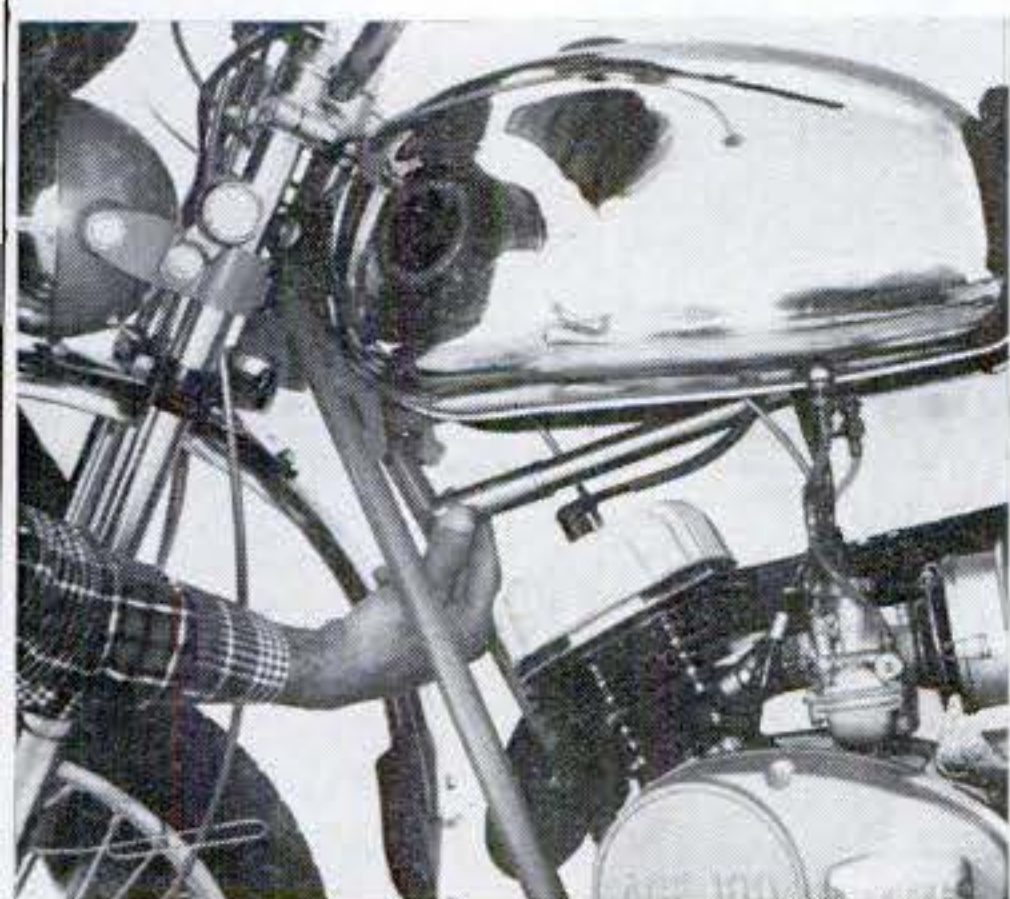
Keep in mind that these gadgets are just representatives of particular categories. In many cases, similar devices—some better, some worse—are made by other manufacturers.

Some are simply offshoot gadgets of other gadgets. Don't be fooled by space-age knobs and dials or meaningless lights. Remember, for each additional piece of wizardry, there's a charge.

Gadgetry can sometimes fall over that shadowy line marked impractical. Before you buy, think out exactly what the gadget does and how it goes about it. If you need it, buy it. If it will waste your money, leave it with the salesman who claims it's so "handy."



Ready for about any trail you are, the 100B's got raised fenders, plenty of ground clearance, and a high muffler.



Besides a well-stocked tool kit, the Hodaka has a tire pump under the gas tank—an item you won't find on most machines.



There's plenty of power on tap to climb most obstacles you'll find out on the trail.

Small Price, Big Action—Hodaka's 100B

Looking for a good trail machine with a reasonable price tag? Look at this one

By JIM DAVIS / PS West Coast Editor

Dependability, performance, and good looks—in spite of a low price tag—that's what you get with the Hodaka 100B. As reliable as sunrise, the 98cc two-stroke engine on the test bike started for me on the first kick every time.

The suspension is great. Progressive-rate springs, front and rear, and two-way oil damping provide a very stable ride over rough ground. And take it from me, there's a lot to be said for a trail bike with good suspension. After a day on a rough trail with a poorly suspended bike, your muscles are howling, and you've probably upset half a dozen times more than you would with a well-sprung machine.

The 100B doesn't take all the work out of trail riding, but it makes

bouncing along the trail as easy as it's likely to get. The seat is one of the most comfortable for long periods that you'll find.

Controls? They operate smoothly and are well positioned. The handlebars are comfortable. Grabbing the handgrips and climbing on the 100B is something like stepping into a tailor-made suit—everything fits just right. A complete tool kit, a sturdy

luggage rack, and a conveniently mounted tire pump are frosting on an already attractive package.

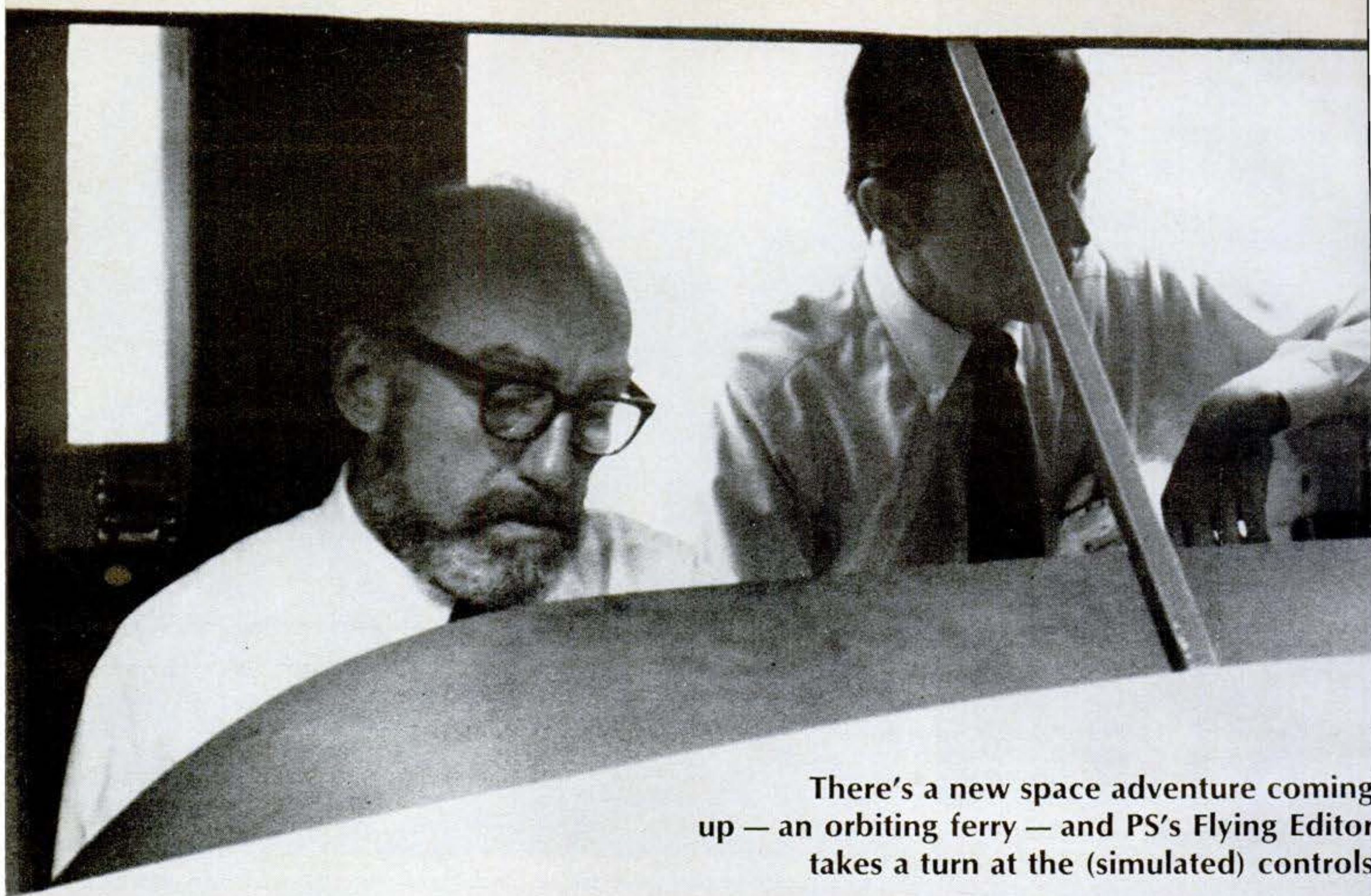
Color? You can have any color you want as long as it's red. But there's more to a quality motorcycle than color options. And most of those good things are in this bike. If there's a trail bike in your future, the Hodaka 100B could just be what you've been looking for. **PS**



A spark arrester—U.S. Forestry approved—makes woods-riding safe. Luggage rack gives carrying space on extended rides.

100B SPECS

Engine type	Two-stroke
Bore & stroke	1.97 in. x 1.97 in.
Displacement	98cc (5.99 cu. in.)
Compression ratio	6.7:1
Clutch type	Wet, multiplate disk
Primary drive	Helical-cut gears
Final drive	Single-row chain
Transmission	5-speed, constant-mesh
Gear ratios (overall)	1st—30.49:1 2nd—18.64:1 3rd—13.07:1 4th—10.37:1 5th—8.71:1
Front tire	2.75 x 19
Rear tire	3.00 x 18
Wheelbase	50 in.
Saddle height	32 in.
Weight	188 lbs.
Gas-tank capacity	2 3/4 gal.
Electrical system	Alternator; head- and tail-light; horn
Ground clearance	11.2 in.
Price	\$495



There's a new space adventure coming up — an orbiting ferry — and PS's Flying Editor takes a turn at the (simulated) controls

'Fly' with Me on a Space-Shuttle

With the recent Presidential order to NASA to proceed "at once" to develop a space shuttle, our first space ferry may be only six years away. Some of the original proposals, which included a manned, flyable, re-usable booster, have been scaled down. Present plans call for nonflying

booster rockets: either recoverable liquid-fueled or expendable solid-fueled. The shuttle will carry an external fuel tank that can be jettisoned in space. Development cost of two flight-test vehicles, says NASA Administrator James Fletcher: an estimated \$5.5 billion.

By **BEN KOCIVAR** / PS Consulting Editor, Flying

Ever think of how it would be to have a 1,000 batting average? I did recently. Only trouble was, I was batting 1,000 percent wrong.

Three times I tried to land the space shuttle. You guessed it; three times I pranged, and didn't make it.

Of course, it was a simulator. The real space shuttle won't be flying until around 1978. Still, I was the first reporter permitted to "fly" the simulator and it was an ego-satisfying—if frustrating—experience.

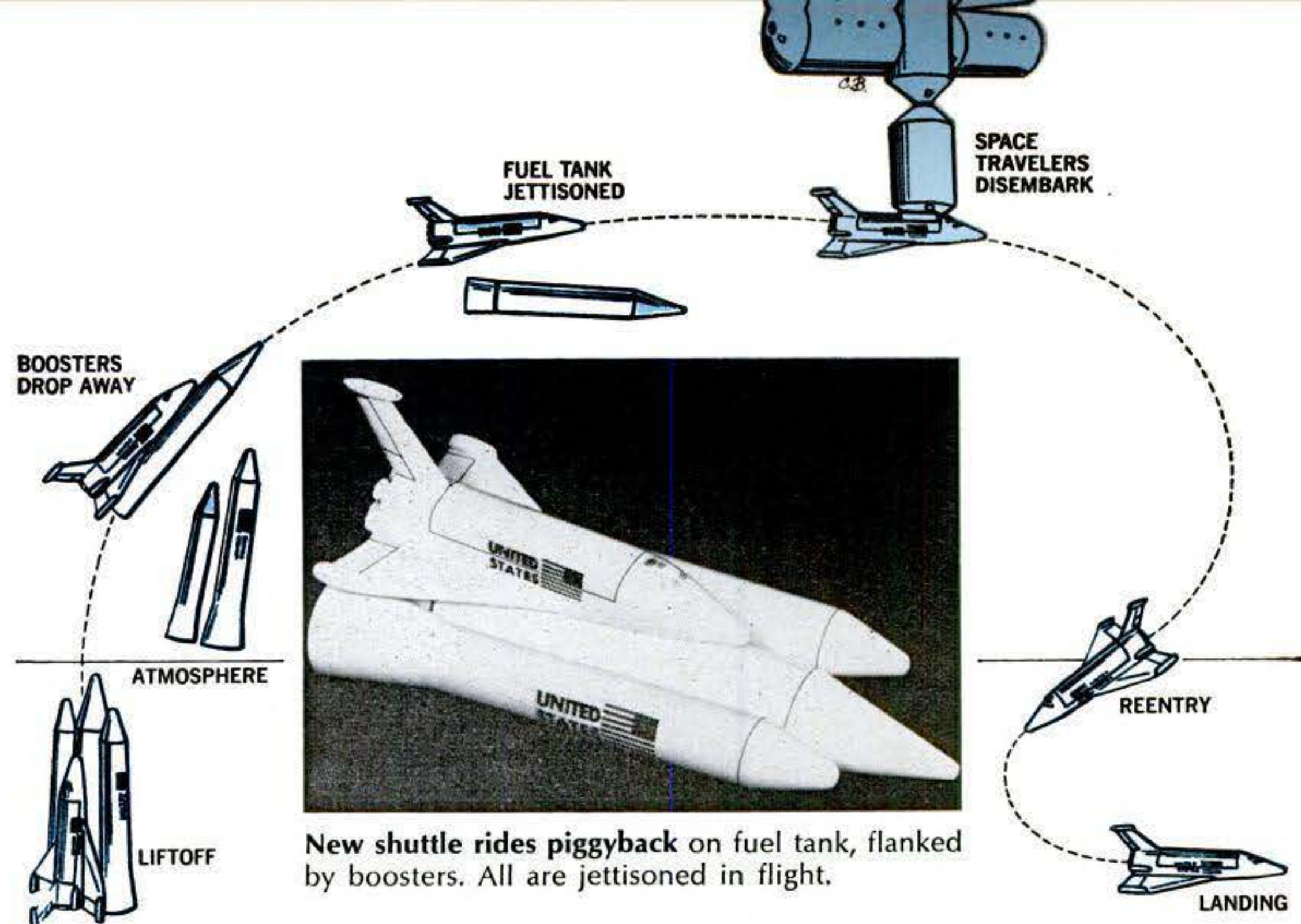
The simulator I flew was built by McDonnell Douglas in St. Louis as an engineering tool. They're using it to design into upcoming space vehicles the kind of performance that will match vehicle control to the abilities of skilled airline pilots.

Reason? The shuttle is being designed with airline-type operations in mind. Three aerospace teams are competing for the honor and money of coming up with the best designs and total concepts. McDonnell Douglas heads

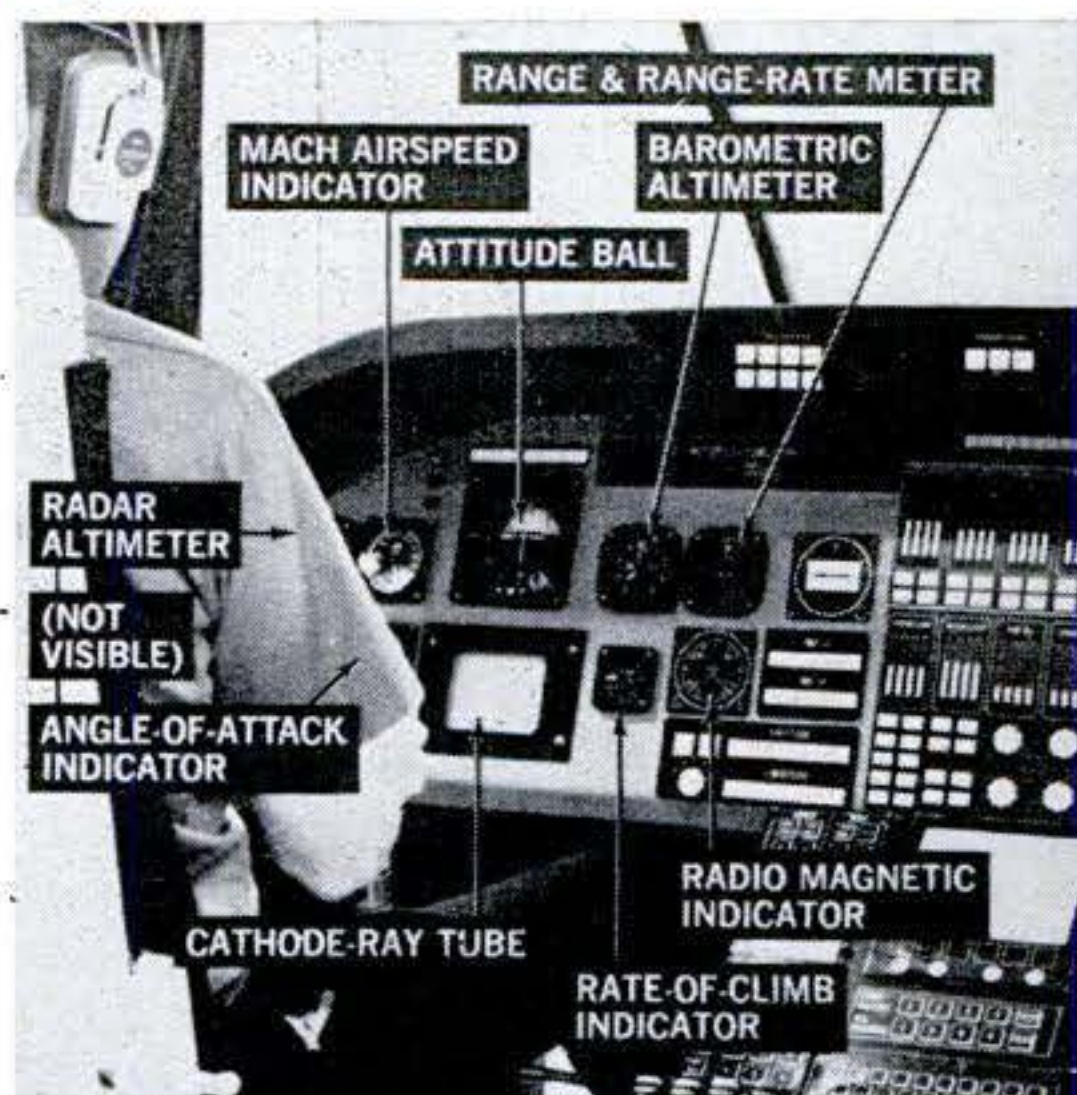
one team, North American Rockwell is teamed with General Dynamics, and Grumman Aerospace with Boeing.

The basic job of the space shuttle? To make it cheaper to get a pound of payload into space. Now we do it the expensive way—with one-time vehicles. And the tab runs between \$600 and \$700 for every pound delivered to orbit. The shuttle will be re-usable, so we won't have to buy a new one for every launch. It will cut the price to about \$100 per pound, and thus will be a fairly economical way of running astronauts, engineers, and scientists back and forth from orbit, and supplying space stations.

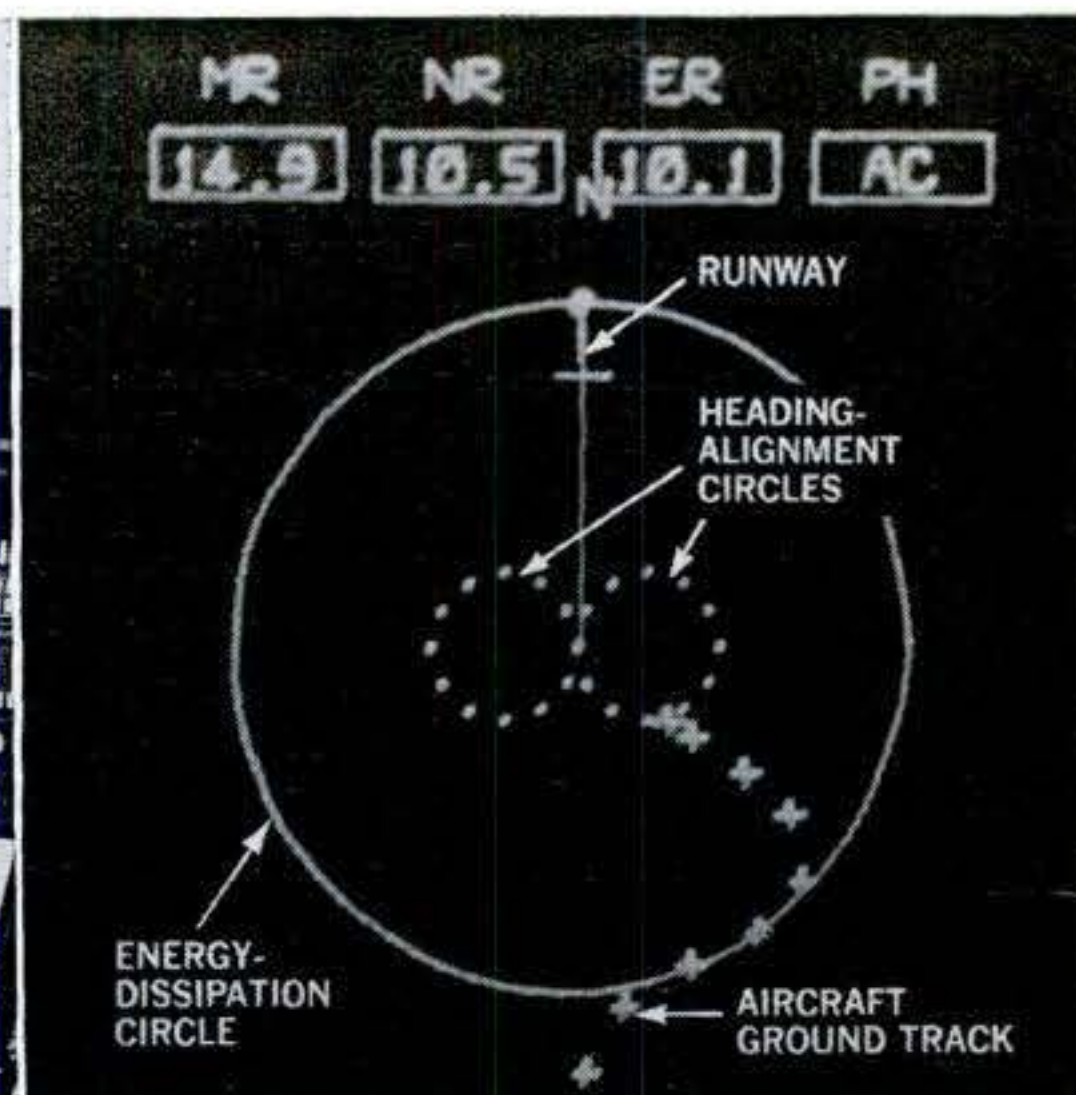
As now conceived, the shuttle will be a piggyback pair of machines. The booster will carry the orbiter up to 200,000 feet, detach itself, and come back to Earth—for recovery and possible re-use (if liquid-fueled; but will be expendable if solid-fueled). The orbiter, about the size of a DC-9, will go on around the Earth—carrying up to 12 passengers and a crew of four—to rendezvous with a permanent space station. It will then return to Earth and land on an airport runway. Unlike our Apollo mooncraft, usable only once, a shuttle may be good for 100 flights.



New shuttle rides piggyback on fuel tank, flanked by boosters. All are jettisoned in flight.



Cockpit instrument panel is like modernized airliner layout. New concept: cathode-ray tube.



CRT can vary displays. This one shows energy-dissipation circle with "shuttle" ground track.

In copilot's seat of "shuttle" cockpit, author Ben Kocivar finds shirt-sleeve environment more like that of a jetliner's front office than of a small space capsule.

Landing

Sound simple? It is not. Very much not. To learn more about the problems and promises, I wangled an invitation to try the first shuttle-landing simulator. As a warmup, I met Stan Cobb, a pilot for Pan American World Airways.

"Technical Pilot, Space Shuttle." That's how Stan's Pan-Am calling card identifies him. The best way to learn is by doing, and I soon found myself copilot with Stan on one of PanAm's Boeing 707 flight simulators at JFK Airport in New York. Stan is not only a veteran 707 driver; he was a Navy test pilot on some of our hottest jet fighters. He is one of three PanAm pilots devoting full time to the space-shuttle project.

As we took off in the 707 simulator, Stan pressed a panel button and one of the four engines went off. He had cranked in an engine flameout on takeoff. We climbed up to safe two-engine speed and altitude. (We actually had three engines going, but you fly fast as though you might get down to two.) We fooled around with a few other simulated emergencies and then proceeded to make some "high-energy" landings. High energy is a neat engineering phrase that means you come in to make a landing at about 200 knots instead of 140.

The point of the exercise was to get the feel of heavier control forces and bigger energy that had to be dissipated in landing—as we would experience in the shuttle simulator. We tried a few and the next day we were in St. Louis seated in the new space-shuttle simulator. It has

a two-seater, side-by-side airline-type cockpit. It has airline seats rather than astronaut couches, and the instrument panel is much like the new DC-10 trijet layout—amazingly uncluttered compared to the maze of dials and knobs of previous spacecraft. Out in front of the window is a giant screen with a projected view from 30,000 feet, with clouds covering the ground.

The drill is to fly down through the cloud cover. Then a projected ground view, complete with instrument-landing-system runway, comes into view. All of this is projected via closed-circuit TV by a moving camera in a room behind the simulator—much like other simulator aids for pilot training. The camera, on a dolly, moves along a track, forward and back, side to side, and up and down. On a wall beside it is a model landscape with miniature highways, rivers, mountains, trees, and a jet runway complete with approach lights. The camera projects a view amazingly similar to what a pilot sees from his cockpit. A computer, linked to the cockpit, tells the camera how fast and where to move.

Its own guinea pig. The basic idea is to make the simulator behave the way the real shuttle will. What makes this simulator fascinating is that scientists are not quite sure how they want the shuttle to "fly," and the equipment is actually being used to help design the orbiter.

The cockpit instruments are basic. There are no engine controls or instruments yet. At the moment, one thought

Continued



Computer-controlled camera scans landscape, moving in all directions, to picture what pilot would see at height and speed.

is that the orbiter might dead-stick into the airport, which would make it the world's biggest glider. It means you must make the landing right, the first and only time. Some consideration is still being given to the possibility of having engines for landing, but this would add considerable weight, reduce range, and add many complications. It might also return by parachute, as our previous space missions have.

But this defeats many advantages of the space-shuttle concept, which calls for quick turnaround re-use of the vehicle in about 10 days. (This is in keeping with the fantastic reduction in time taken to launch in the first place. Present Apollos spend months on a launching pad before liftoff. The space shuttle would go into orbit about 24 hours after leaving its hangar.)

In the pilot's seat. The first thing that strikes you is that you have a control stick instead of an airline yoke or wheel. The stick grip has trim buttons and autopilot release switch, and has the general feel of a jet-fighter control stick. Instruments include airspeed, altimeter, flight director, and rate-of-climb indicator—all fairly standard airline stuff.

One interesting item is an angle-of-attack indicator. And most exciting are a set of cathode-ray tubes that work like the picture tube on your TV set, with a switch that gives a choice of presentations. In this first mockup the tube would present an area-navigation display with a track of dots to show the flight path of the shuttle. As the ship gets closer to the landing, the tube switches to a glide-slope display to show whether the ship is coming in too high or too low.

When returning from space, once you hit the atmosphere at 100,000 feet, you have a choice of landing spots as much as 20 miles apart. This gives you several possible landing fields at a place like Cape Kennedy. At 100,000 feet you're also less than 1/2-hour from landing and should know precise weather conditions.

The mission we practiced was coming in for a landing starting at 30,000 feet. At that altitude, the speed should be reduced to 260 knots. By 8,000 feet, the speed should be 240 knots and the plane must be lined up for a specific landing strip. Coming into the instrument-landing system, the angle of descent is much steeper than for an air-

liner: 12 degrees versus the usual three degrees. You start flaring at about 800 feet and the speed slows down very quickly with touchdown at 180 knots. With drag chutes deployed, the landing roll is about 6,000 feet.

That, of course, is the flight plan. I flubbed. The best I did was to get within a mile of the airport before crashing. Stan Cobb got the ship on the runway most of the time, but then it seemed to "balloon."

Bugs in space, too? There are obviously things to be worked out. Stan thought one difficulty might lie in the projected image and problems of depth perception at high rates of descent. The image seemed adequate for simulated 707 landings at a rate of descent under 10 feet per second. On the shuttle, however, the rate of descent is about 90 f.p.s. because of the steeper glide-slope angle and faster speed on approach. Remember—this simulator is not for teaching pilots how to land. Its job is to teach instrument functions and cockpit layout. Actual landing simulators will come later.

I asked Henry Paulsen, who is helping develop the shuttle concept for McDonnell Douglas, what big problems were still to be faced. We came up with these interesting bits:

While NASA has principal responsibility for design, the vehicle must be usable for both manned and unmanned flights by NASA, possible military use by the Department of Defense, and also for possible international use. Some people feel that if military missions were excluded the shuttle could be smaller.

It will be capable of both polar and equatorial orbits. Launching due east from Cape Kennedy offers the best payload possibility. Polar orbits are for military surveillance and earth-resources exploration.

Among the big problems to be resolved is vehicle size. The liftoff weight is estimated at 4.7 million pounds; the payload for an easterly launch may vary from 15,000 to 70,000 pounds.

Drastically reduced ground support—compared with present launches—will give the shuttle routine operation with airline reliability. To achieve low cost, the ground support must be reduced by a factor of at least 10. On-board checkout systems are standard on airliners and this is one of the high-priority aims for the shuttle.

Landing on runways is desirable, but there are other possibilities. A shuttle that would parachute into the water like the Apollo costs less to produce but more to operate.

How skilled must the crews be? Paulsen thinks they will be qualified somewhere between test pilots and present astronauts. They will have more navigational training than test pilots and there will be a trend toward scientist-astronauts.

Present plans are to launch and retrieve the shuttle at the Kennedy Space Center in Florida, but there are other possibilities: White Sands, N.M., Vandenberg AFB in California, and the whole state of Utah.

Launching sites should have dry good weather. Temperature makes little difference, but height over sea level does: A launching altitude at 4,000 feet or over offers some advantages.

Are the Russians considering a shuttle? There is evidence that they are. And the announcement that the U.S. and the Soviet Union have agreed to develop mutually compatible rendezvous and docking systems opens up many possibilities.

Space hookups between nations will obviously require not only the greatest exchange of technical information, but also great mutual trust, because it would be unrealistic to think that military efforts could be isolated from the purely civilian.

The future astronaut may need, among his qualifications, a knowledge of Russian. And Chinese, too? [P 5]

OMC's First Jet Kicks Off



Jumping a gravel bar repeatedly at speed left the OMC's impeller unharmed.



Running her wide open, Roe throws throttle through neutral into wide-open reverse. A ball of mad water rises and he stops pronto.

With a high-cam engine, this jet gives great performance within economical hp range

By JIM ROE / PS Boating Editor

Now there's an Outboard Marine jet stern drive. It is just announced, just available, and we have just tested it for you in the waters of Naples Bay in south Florida.

Dewey Craig, in charge of OMC's big test station in Naples, had the jet installed for us in a new Cobra boat with the engine tuned, ready for us to take off. So we stopped in the test station only long enough to take a careful look at the new jet-drive unit with the boat up on hoists.

The jet pump is coupled to a 307-

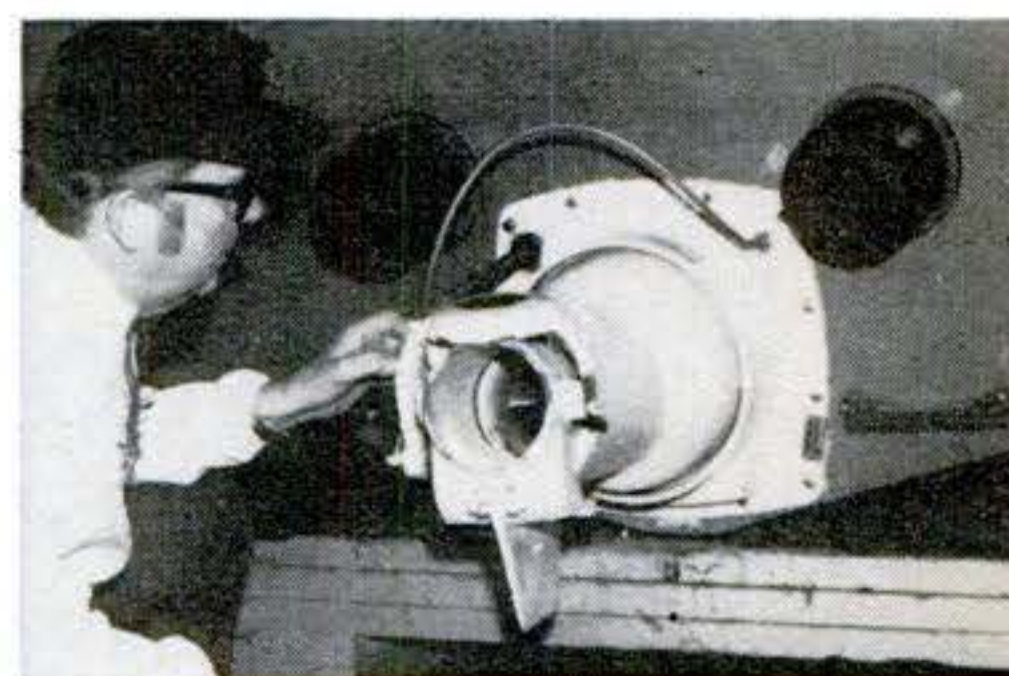
cu.-in., 245-hp OMC engine. This gives its six stainless-steel impeller blades a good deal of authority. In fact, the Jacuzzi engineers who designed the pump say she can pump as much as 5,400 gallons of water per minute, spinning at 4,500 rpm.

To find out more about this jet I had earlier talked to Ralph Lambert, chief engineer of the OMC stern-drive operation in Waukegan, Ill. Ralph told me this new pump is a Jacuzzi YJ model. It differs from the previous WJ model in that the impeller is designed to give higher efficiency at mid-range speeds. At the same time, it seems to suffer no penalties at higher speeds.

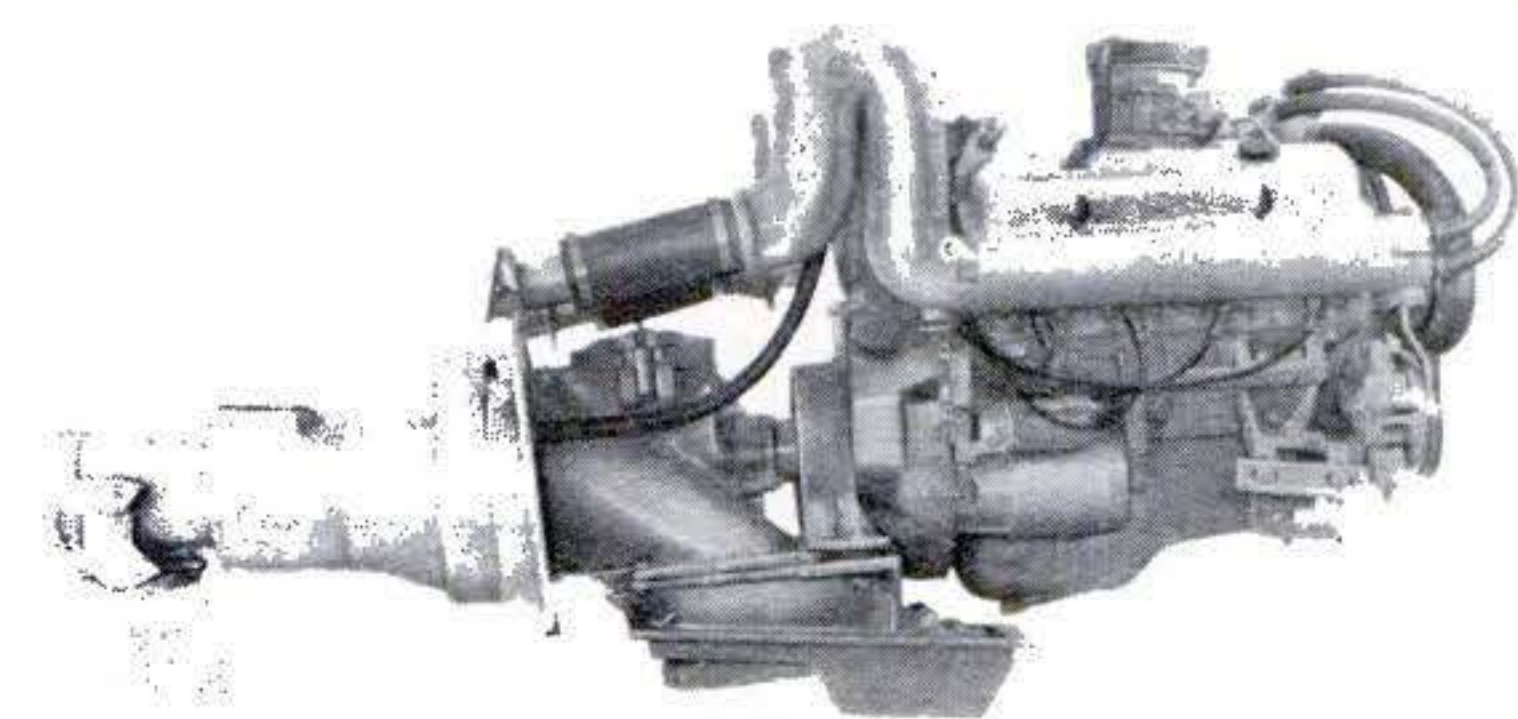
The difference between models lies in the shape of the impeller blades. The new YJ model will keep the boat

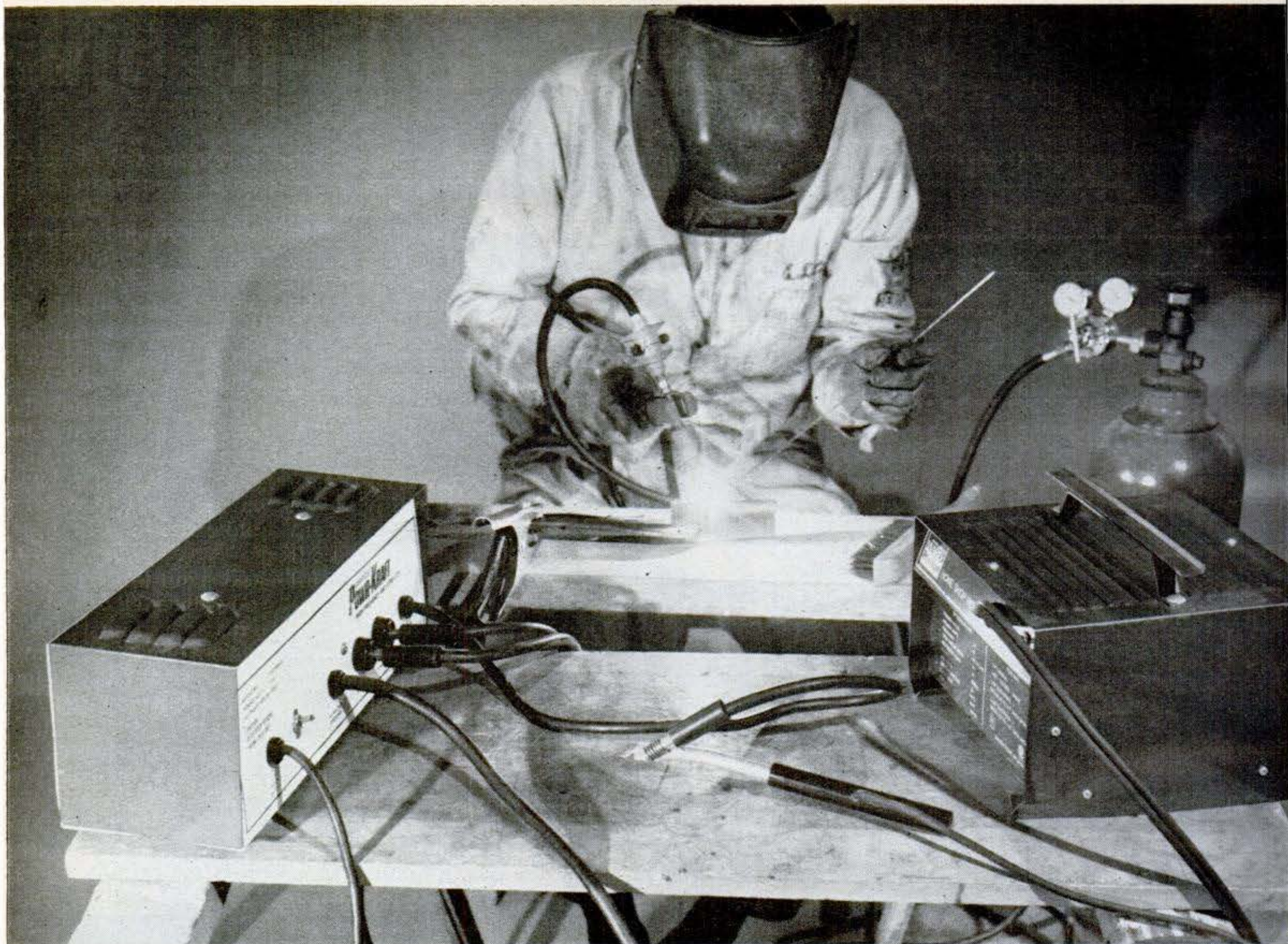
[\[Continued on page 152\]](#)

Jacuzzi jet pump mates to high-cam engine on a direct drive. Nozzle turns 20 degrees in each direction—not as far as prop unit, but gunning it helps turn the boat fast. Note stabilizing innovations: rudder under discharge nozzle, small keels on both sides of the impeller intake screen.



With gate and discharge spout up, as above, boat runs forward. With gate down (photo below) water deflects to reverse the boat.





You can even weld aluminum with Ward's new home-shop welder, high-frequency arc stabilizer (left), and tungsten/inert-gas torch.

Two Home-Shop Welders That

One's for small jobs, the other's for heftier work—and the prices are right

By E. F. LINDSLEY
PS Midwest Editor

Two new arc welders—one a low-cost, home-shop welder, the other a moderate-cost version of a commercial welder—teamed up with a high-frequency arc stabilizer and a DC converter, recently opened my eyes to some new home-shop welding potentials.

I was wary of the \$55 "sputter box," because past experiences with low-price welders were disappointing. Montgomery Ward, sellers of both welders, assured me their little welder could really do the job. They were right.

The \$135, 230-amp welder was a fine performer in its price bracket. When I added the HF (high-frequency) arc stabilizer, a TIG (tungsten/

inert-gas) torch, and a DC converter, it became a workshop dream tool.

Home-shop box. First, I tried the small welder. Surprisingly, it was not a resistance pot but a well-built transformer unit, with husky windings, an on/off switch, and a third-wire-grounded metal housing with carrying handle. Obviously, at this price you give up some things—like variable output. The home-shop welder puts out a hot, and very stable, 50 amps.

Here's what I found out about the small home-shop welder:

- On most household and workshop jobs, you'll get sound, if not always pretty, welds.

- Heavy metal used small $\frac{1}{16}$ -inch rods rather quickly.

- The carbon-arc torch was great for brazing, bending, and tempering.

- Automobile-thickness steel welded beautifully without burn-throughs. Best rod for this is $\frac{5}{64}$ inch.

I was eager to try the TIG-torch outfit with the 230-amp unit. Amazingly, it even worked with the home-

shop box. The HF arc stabilizer jacks up the frequency to:

- Start the arc without touching the electrode to the metal.

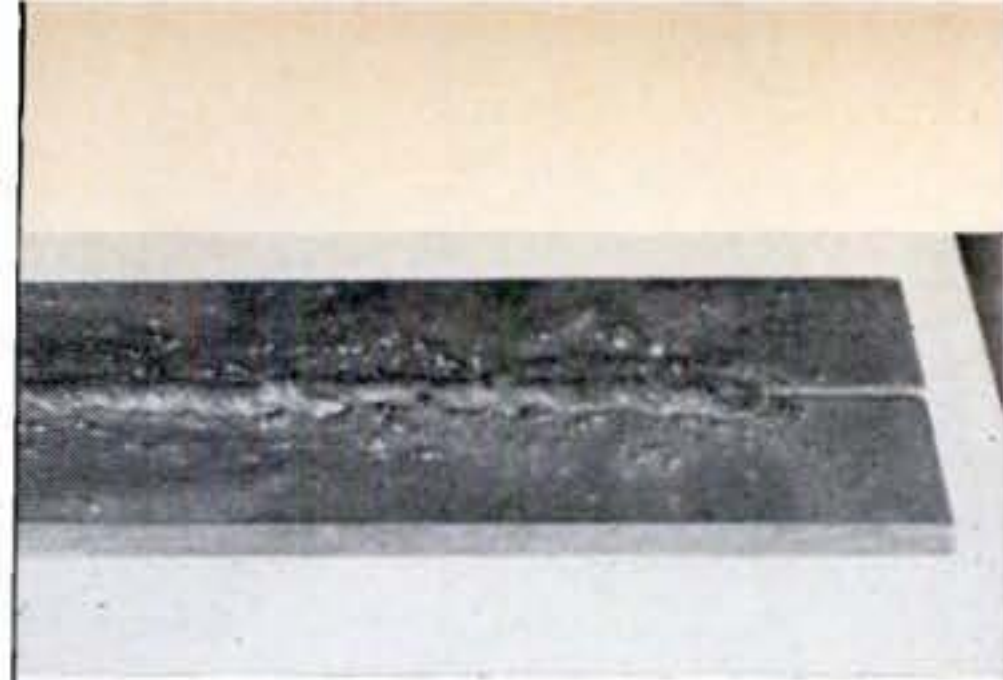
- Stabilize the arc and permit drawing a longer arc when needed.

- Clean the metal surface.

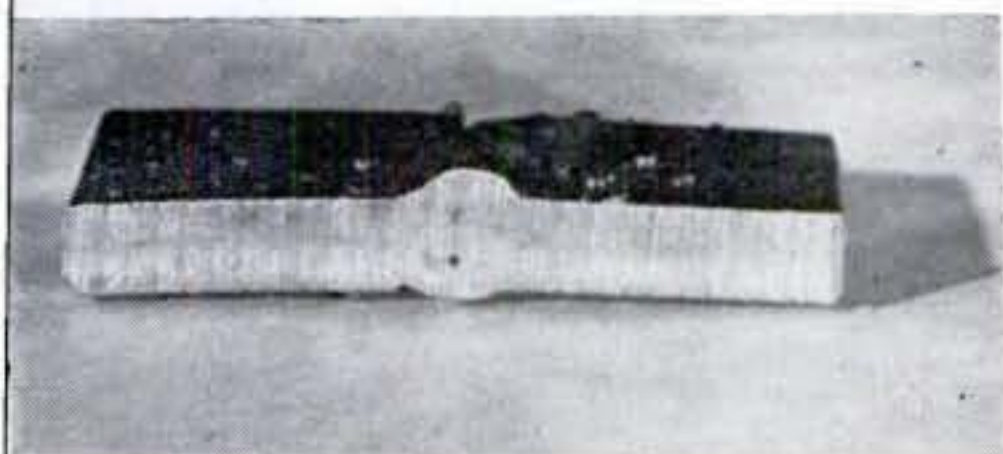
The stabilizer can be used without the torch. Stainless steel, other inherently hard-to-use rods, and low amperages are easier to handle.

TIG welding. Your first experience may startle you. After turning on the main welder, switch on the stabilizer and you hear the sizzling sound of an arc inside the stabilizer housing. You may also see long, thin purple sparks stringing out from the filler-rod tip, your fingertips, or your elbows if you get them near the grounded work while holding the torch.

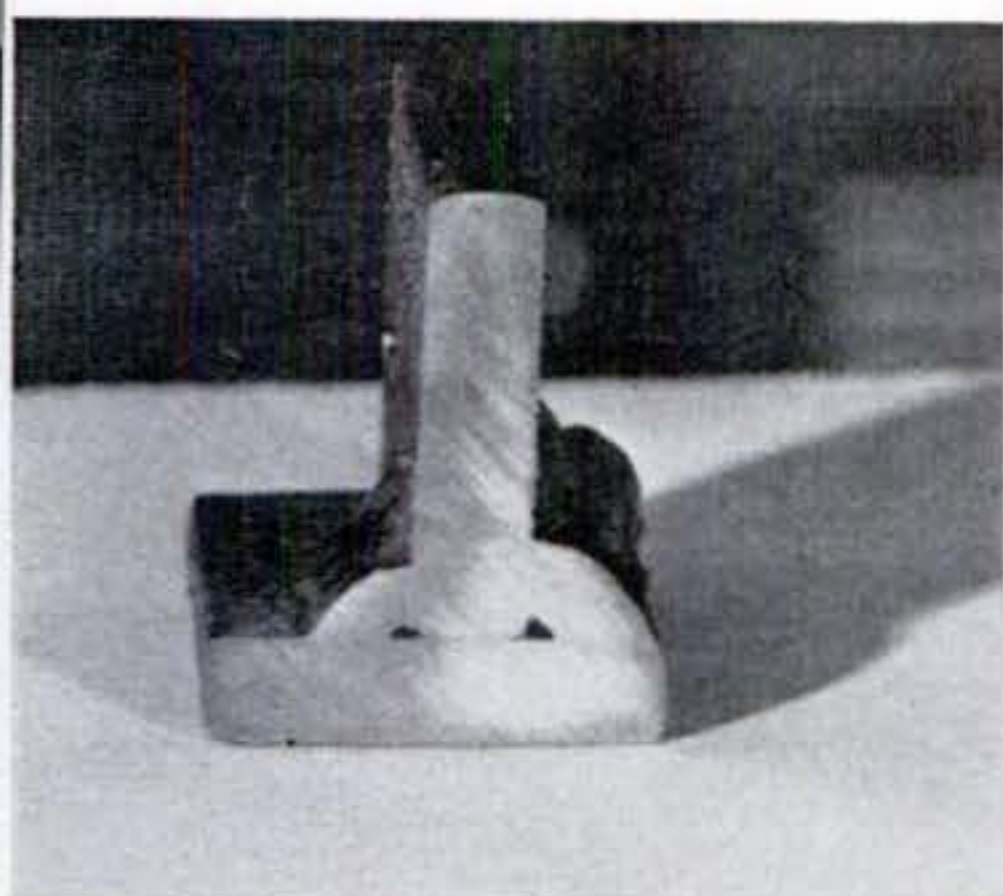
Turn on the gas, flip down the hood, and bring the torch near the work. Expect to hear another sizzle. Then, as the tungsten tip nears the work surface, an arc will jump across in a flame-like manner. In fact, TIG weld-



Author used two 1/8-inch rods to run this four-inch weld. It wasn't neat, but held up.



Sectioned weld suggests grinding V didn't help much. But it's good for small welder.



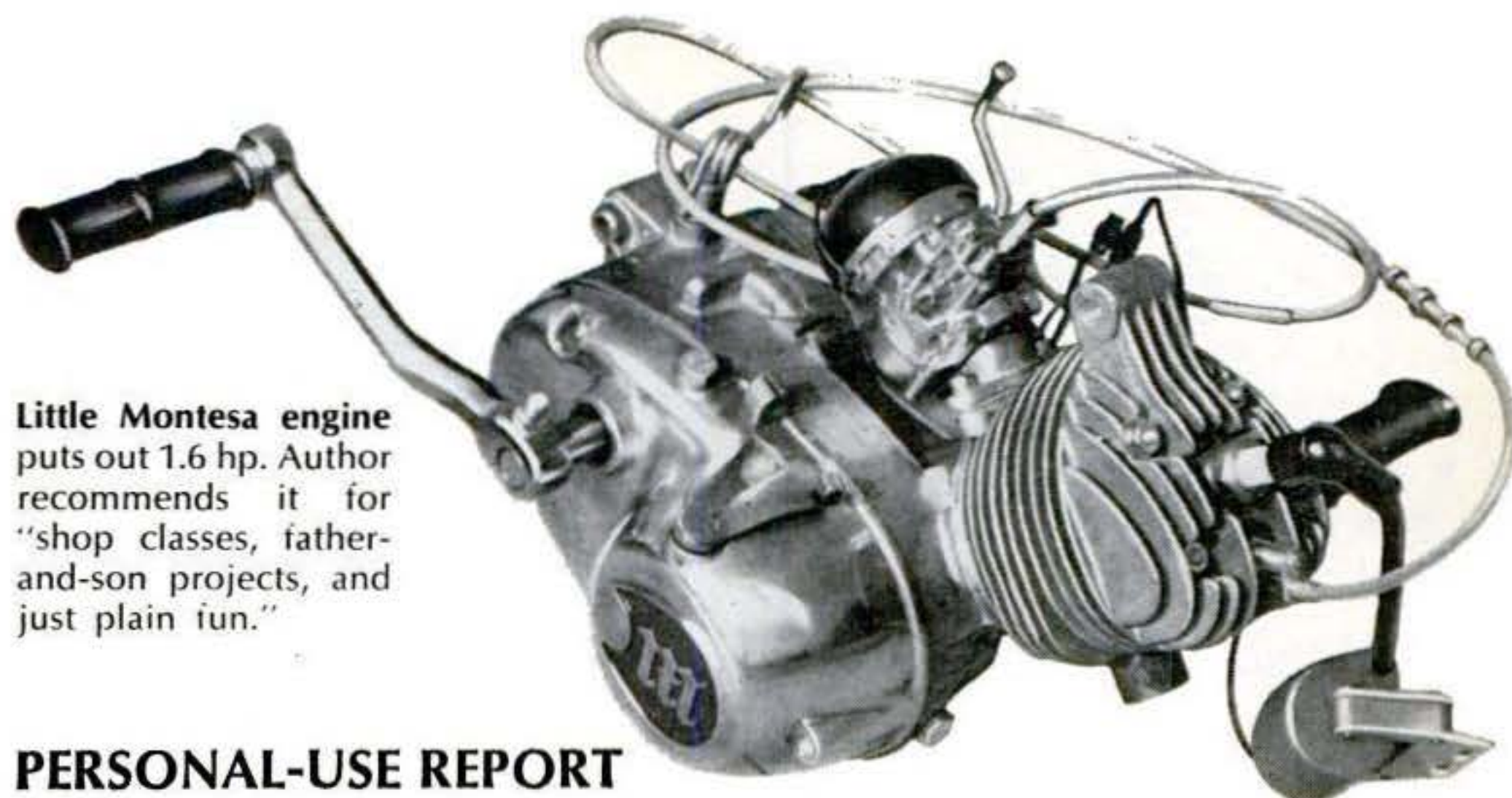
T weld with home-shop box used 1/8-inch rod at left, 3/32-inch at right. Both worked fine, but the small rod was a little neater.

Really Work

ing reminds you of acetylene-gas welding in the method of forming a puddle and feeding in the rod. Don't manipulate the torch like a gas torch, however: It's important to hold the gas shield steady on the work area.

The DC converter. Next I combined this with the HF unit. The basic AC welding power is fed to the DC rectifier and then to the HF stabilizer. Depending upon the job, you can use either straight rod or the TIG torch. With rods, even though you're using HF, observe normal polarity for the rod. Some take straight, others reverse, and sometimes you choose according to heat and penetration requirements. Experienced welders install a foot switch to cut the HF unit once the arc is established.

The HF stabilizer and the TIG outfit cost \$65 each. A tank of argon costs about \$12 but lasts a long time. These make fine additions to either welder—though for heftier work you'll need the 230-amp one. The DC converter at \$149.50 is tops. **[S]**



Little Montesa engine puts out 1.6 hp. Author recommends it for "shop classes, father-and-son projects, and just plain fun."

PERSONAL-USE REPORT

FROM A KIT:

A Little 49cc Two-Stroker

Engines, engines, all around us—in cars, boats, lawn mowers, motorcycles, toys—and yet how many people really know how they work and how they go together? If you're one of those who are hazy about engines, then Montesa—the Spanish manufacturer of the well-known motorcycle of that name—just may have an answer for you: a beautifully made and engineered kit that I've had the fun of using for the past few months.

You start with a package of parts, and with a little care end up with a small 48.7cc engine that not only runs but can be used to power all sorts of projects: generator, battery charger, go-cart, garden equipment, snow-thrasher, portable table saw. My own test engine ended up on a minibike.

It's a snap. I assembled and disassembled the engine once, then turned it over to my 14-year-old son and his buddy to see how they'd make out with it. They put it together in record time—a tribute to the fine instructions—although they did break one of the two piston rings. I then lent the kit to our local high school, where the kids took it apart and put it together several times—and broke the remaining ring. The kit comes with a fine assortment of special tools, but I'd like to see them add a small ring compressor, or at least some extra rings. Just in case.

Here are some specs:

Bore & stroke	38 x 43 mm
Power	1.6 hp at 4,500 rpm
Electrics	alternator magneto flywheel with external high-tension coil
Clutch	automatic centrifugal
Price	\$345 (gulp)

For more information, write to Montesa, 3657 Beverly Blvd., Los Angeles, Calif. 90004.—*Jim Davis*



Kit is complete down to the last nut and bolt. Jim Davis holds two of the special tools that are included with the kit.



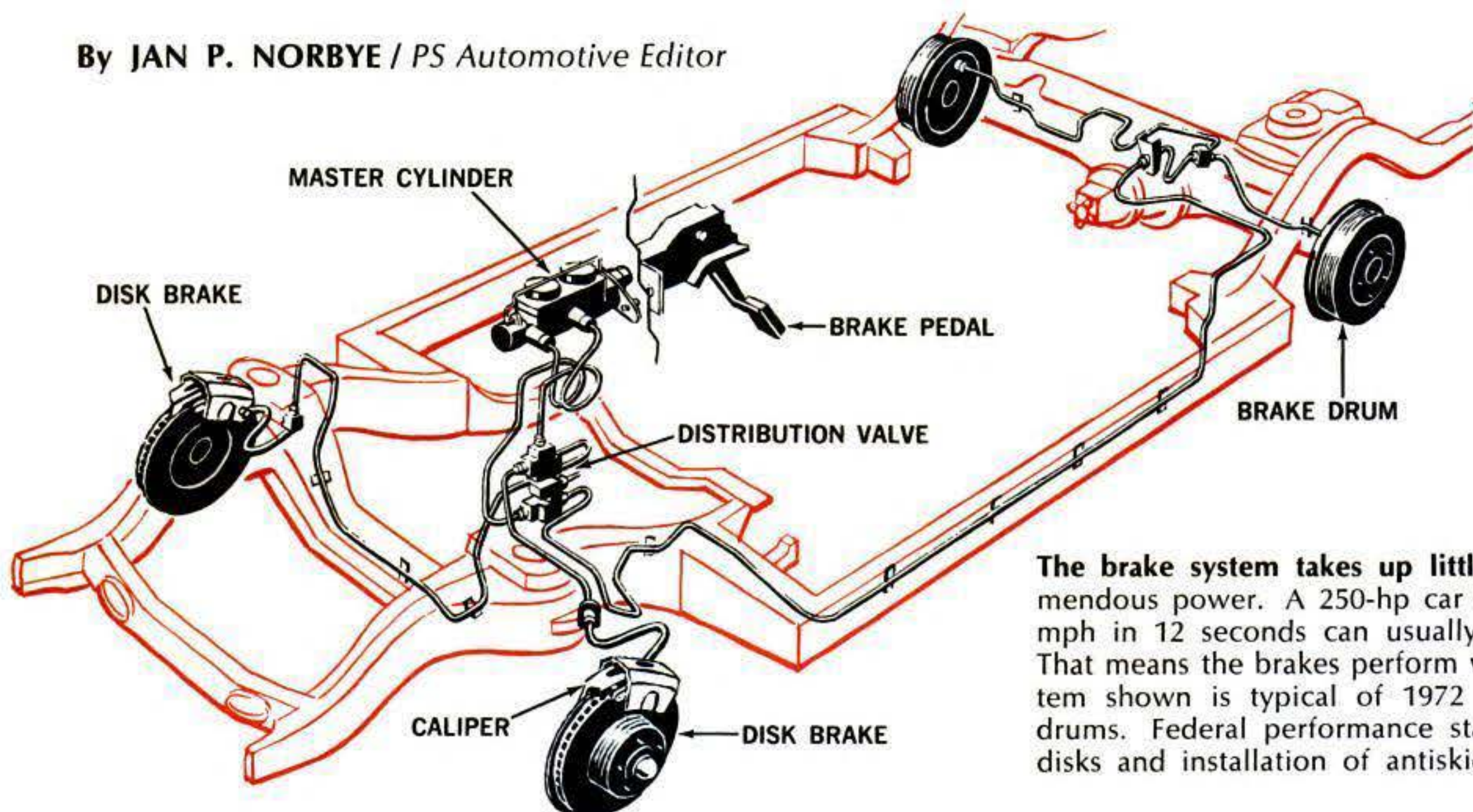
Two 14-year-old boys found assembly easy. The parts are so spotless that they can be put together on the living-room rug.

Some cars have excellent brakes now. But, until we have standards, many cars will be built with inadequate brakes

BRAKE-PERFORMANCE STANDARDS:

What's Holding Them Up?

By JAN P. NORBYE / PS Automotive Editor



Brakes are your No. One safety

The brake system takes up little space in the car, but has tremendous power. A 250-hp car that can accelerate from 0 to 60 mph in 12 seconds can usually stop from 60 in four seconds! That means the brakes perform work equal to 750 hp. Brake system shown is typical of 1972 cars, with front disks and rear drums. Federal performance standards may lead to four-wheel disks and installation of antiskid or antilocking devices.

You've been hearing about brake-performance standards for years now. Provision for them was made in the Highway Safety Act of 1966. In '68, the Department of Transportation (DoT) began to publish brake-performance data on U.S. and imported cars "to provide consumers with comparative information that will assist making a more intelligent choice in buying a car."

They publish the stopping distance for each car from 60 mph, but the car that needs 244 feet is still just as legal as the car that stops in 100 feet less.

Shouldn't there be a limit? Yes, that's what a performance standard implies. Cars that cannot stop within the limit should be declared illegal.

To get better brakes. That's the whole idea behind the standards. I'd like to see four-wheel disks and antiskid on all cars, but DoT can't order auto makers to do that. That's "design-restrictive." DoT can only set performance standards—but it *can* set its goals so that four-wheel disks and antiskid may be necessary to meet them. Standards are intended as a spur to improvement; the industry knows this. Rockwell-Standard, big in truck brakes, sees the standards "as a means to maximize vehicle control and stability for safety."

A stopping distance of 185 feet from 60 mph is one of the requirements in the proposed DoT standards due to go into effect on September 1, 1973. That's almost 18 months away. Why not now? Read on, and you'll see. But first look at the conditions for the 60-mph stop:

- No wheel locking (skidding).
- Pedal pressure not exceeding 150 pounds.
- Fuel tank 90-100 percent full.
- Transmission in neutral.
- Normal tire pressures.
- Inside 12-foot-wide lane.

- Zero gradient, zero wind.
- All doors and windows closed.
- Ambient temperature 32 to 100 degrees F.

The first requirement (no locking) introduces a human factor. Do the results mean anything?

According to tests made by Bendix, the computed standard deviation by expert drivers over many stops with the same car was 19.5 feet at 60 mph. That's surprisingly high. Perhaps a different car would have given better results. But if we are to accept the 19.5 figure, the 185-foot limit could be too low. The proposed standard would be a victim of the laws of statistics. Most cars *can* stop from 60 in under 185 feet. But if you say *all cars must* match such stops, you are up against a lot of problems (due to the vast numbers of cars produced and the many variable factors at play).

You might think that the auto makers would be on the safe side if they aimed for an average stopping distance of 185 feet less 19.5. But that's not so. The 19.5 number is an average, and absolute deviation may go to three or four times the average. Bendix says that to assure that 99.5 percent of stops come within the limit, they must aim for 185 feet less three times 19.5, or 126.5 feet. That represents an average deceleration of more than 30 ft/sec² or right up to one g. Is it feasible? Under certain conditions, yes. But perhaps not under those specified in the proposed standard.

DoT calls for a test surface with an ASTM skid number of 75 (on a 0-100 scale) which more or less corresponds to a friction coefficient of 0.75. Japanese car makers say a skid number of 75 is considered low, based on actual road conditions and test courses, and recommend 80. Volkswagen states flatly it cannot meet required deceleration on 75 skid-number surfaces. If that



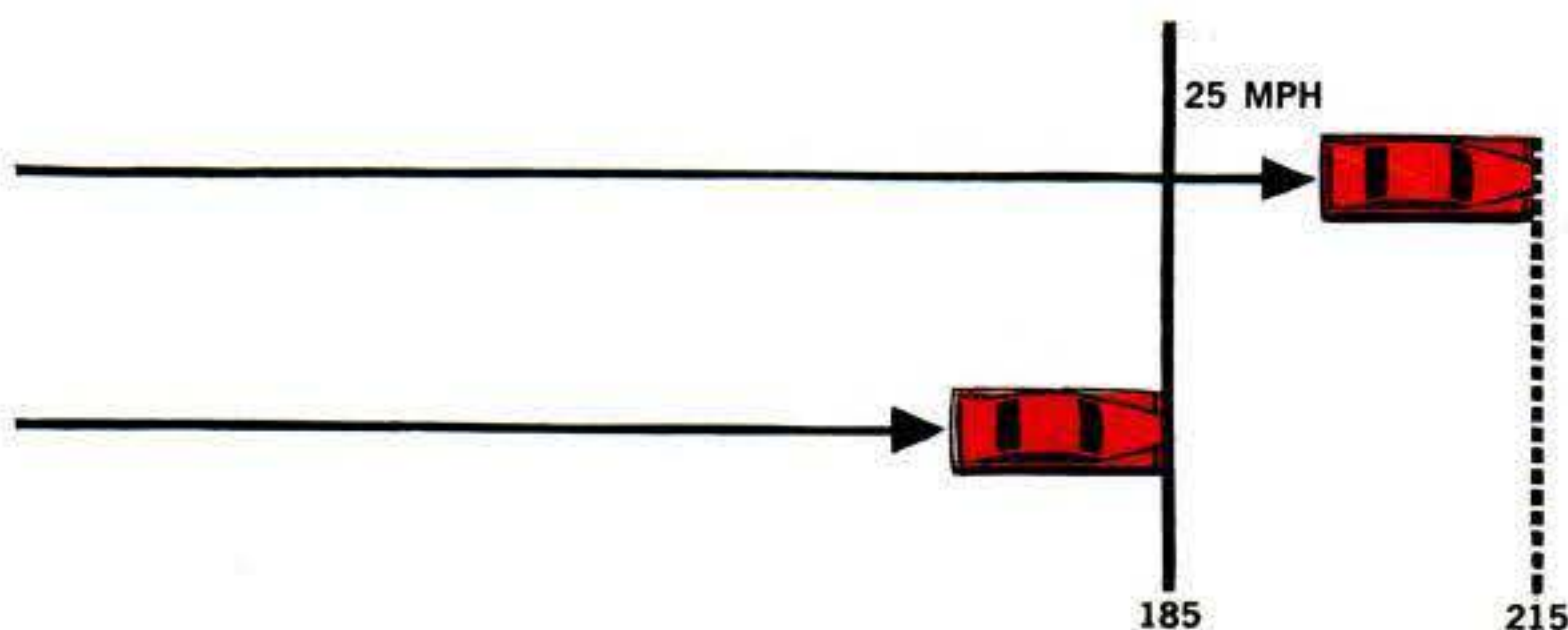
device. Good brakes will do more than just stop your car—they will handle the job without your losing control of the car.

is not changed, VW recommends 0.62 g or 20 ft/sec² deceleration. Does VW have a braking problem? We have tested a number of VWs over the years, and they have terrific brakes. Several stopped with deceleration in excess of one g.

But we test at Bridgehampton race circuit, which has a very abrasive surface, with a skid number around 100. Most cars we test stop far shorter than claimed by the makers. Our chart (next page) shows that 23 cars we tested in the past 12 months stopped short of 185 feet without exceeding 150 pounds' pedal pressure (with cool brakes). Many stopped so far short of 185 feet that it should be possible for them to stay within the limit, even with the 75 skid number. Some of our findings vs. claims:

	Maker	PS
Ford Torino	179	136
Chevelle	219	132
Satellite	195	159
Buick	208	130
Oldsmobile	208	135
Mercury	186	130
Chrysler	200	146

PS figures are for tests with lightly loaded cars (two men plus minimum equipment). Add 25 percent to our figures to make up for the roadway difference, and all but the Satellite are still under the limit.



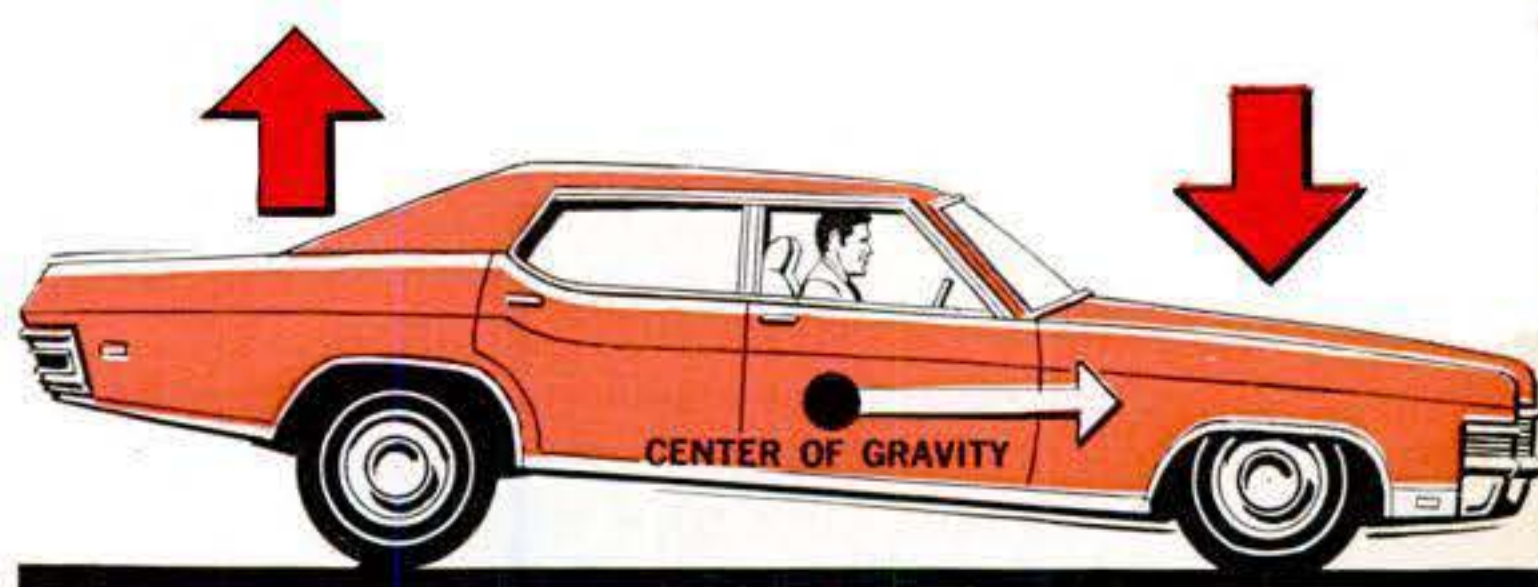
Importance of short stopping distance is seen in this graph. The car that stops from 60 mph in 185 feet avoids hitting the barrier. But the car that needs 215 feet to stop hits the barrier—and is still traveling at a speed of 25 mph at the moment of impact! That represents a serious crash.

Small differences in test methods help explain our short stops. We are not as strict about locking as DoT. We do not allow *front* wheel locking, but tolerate more than momentary *rear* wheel locking (though we try to minimize it). Also, we leave the car in Drive during the test. The human element in any test procedure introduces uncertainty. Even a progressive company like Volvo finds the stopping distances “unacceptable,” because “their values are dependent on driver skill to attain.” They probably fear that a DoT test driver could fail to make their car perform as well as their drivers.

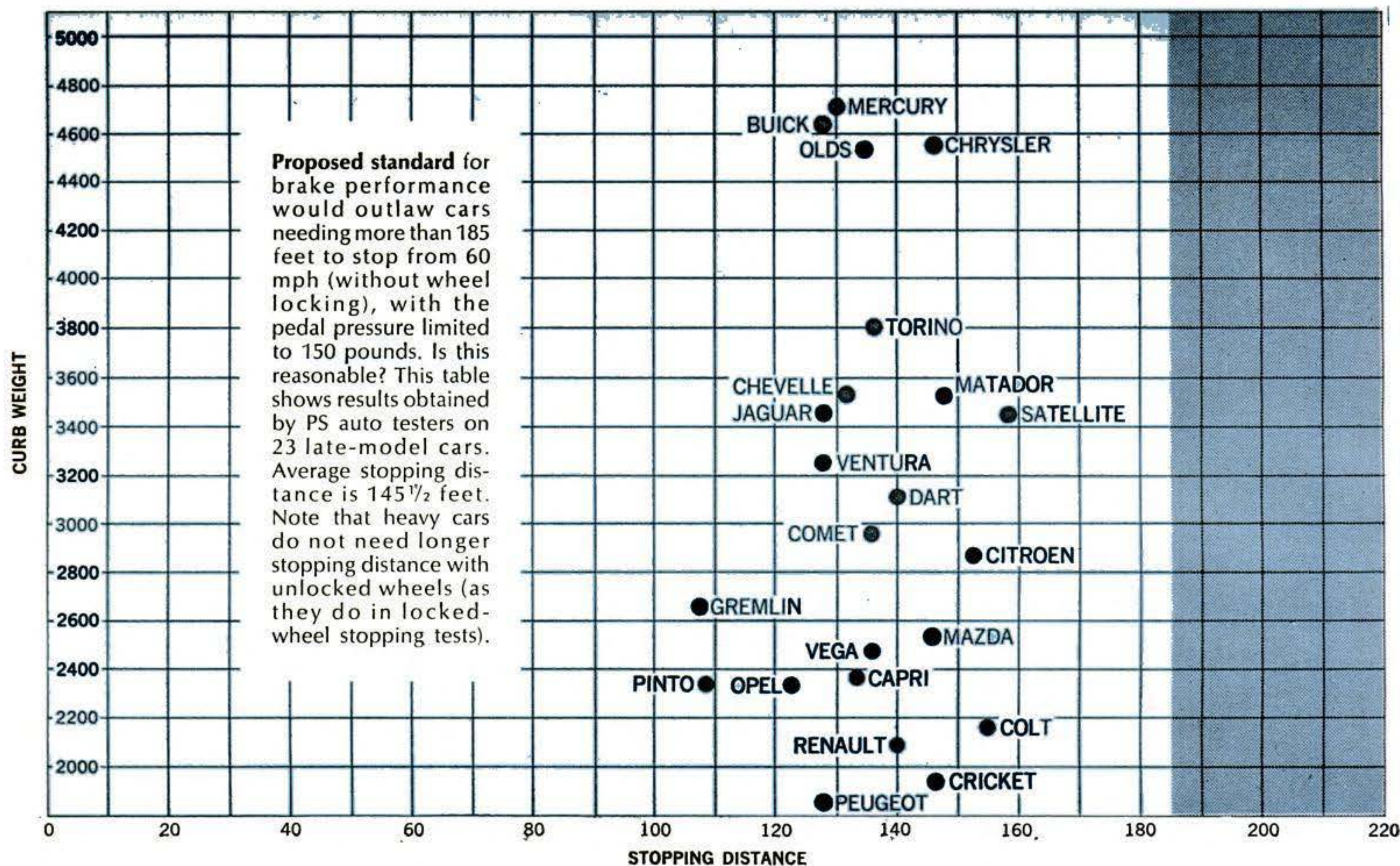
What's the solution? Peugeot suggests using a constant pedal force (not exceeding the maximum allowed), and then checking to see that stopping distance does not exceed the allowed limit. Others recommend locked-wheel brake tests. Ford insists that repeatability of nonlocked wheel tests is poor. Others point out that the average driver, in a panic stop, does not modulate pedal pressure for optimum retardation, but jams on the brakes.

Locked-wheel stops. Isn't the locked-wheel panic stop more representative of on-road conditions than the DoT test? It is, but it's not a brake test. Locked-wheel stops tell you nothing about the brake system. In fact, once you know the vehicle weight, tire size, and road-surface type, you can accurately predict how far the car will skid. The brakes aren't in the picture (except for prov-

Continued



Under hard braking, the car's center of gravity is displaced forward. The car gets heavier in front, lighter in back. Since brake-force distribution is constant (about $\frac{2}{3}$ front and $\frac{1}{3}$ rear), the rear wheels tend to lock and skid. They're no longer capable of their $\frac{1}{3}$ of the braking, due to weight transfer.



ing wheel-locking ability). Brake tests can only be valid as long as lockup is outlawed.

Locking is bad. Rear wheel locking means loss of stability. Front wheel locking gives maximum stability but loss of steering. In a panic stop, all wheels lock at once. In modulated brake tests, many cars lock their rear wheels long before there's any risk of front wheel locking. This is bad. If you are to avoid rear locking, you cannot use your front brakes to the full. If you use your front brakes to the full, the tail end will skid sideways.

Now you see why I think antiskid systems—or anti-lock systems, to be precise—are so important. Used on rear wheels alone, they assure straight stops. Four-wheel antiskid assures shorter stops on all surfaces with full directional control. You may never see antiskid as standard equipment throughout the industry unless brake standards are strict enough to make it necessary.

Making a match. In addition to stops from 30 to 60 and 80 mph, DoT proposes a stop from maximum speed minus five. For years, cars have had a speed capacity beyond any legal limit, but with brakes just about adequate for legal speeds. Now DoT is telling Detroit that brakes must match the car's speed potential. I think you'll agree that that's reasonable. But Chrysler suggests limiting speed "to 100 mph for safety reasons." Are they saying it's unsafe to test brakes at speeds over 100?

High-speed tests will apply to trucks also. Reaction? Borg & Beck Division of Borg-Warner protests that "truck-brake testing at 60 mph is inherently dangerous; also, based on proposal, is dependent on driver skill." If that is so, it is proof that high-speed truck testing is long overdue. Trucks legally run at 60 in many states, illegally in others. If their brakes can't cope with that, trucks are a hazard to other road users.

DoT proposals also call for tests with partial failure in a brake system: stopping with one of the two hydraulic circuits not functioning. The proposed maximum distance at 60 mph is 400 feet, and most auto makers are asking for 450 feet. At this point I think we should recognize the magnificent job the industry has done in building reliable hydraulic systems.

Failure is extremely rare. You could make a good case for leniency here. The trouble is that the standards aim toward improving the full system, and fairly strict standards for partial-failure tests will have to be set to avoid too great a disparity in brake performance in rare cases of failure. Some compromise is indicated.

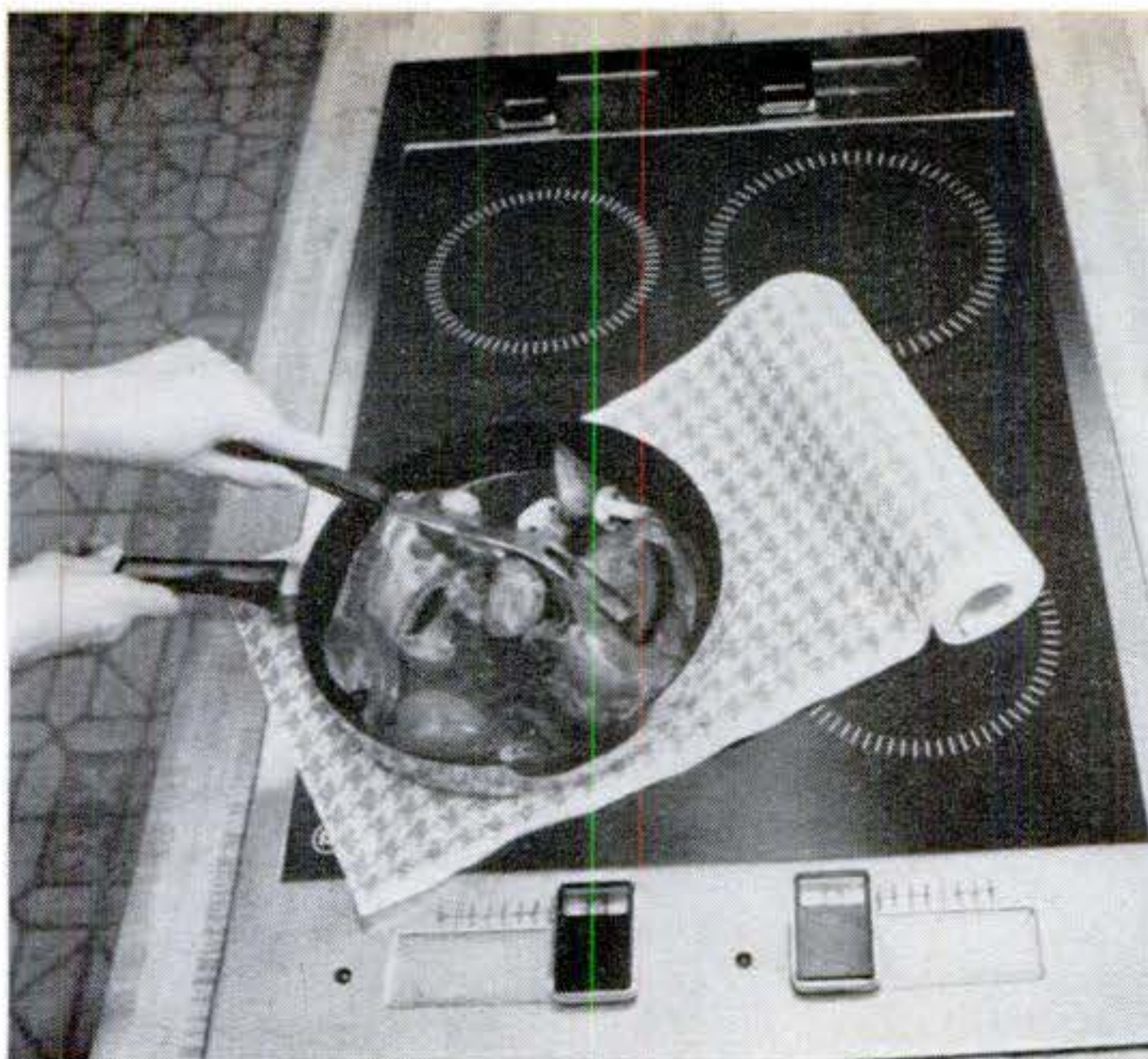
Citroën has requested the DoT's adoption of ECE (European) regulations for partial failure in stopping distances. These call for stopping at 30 percent retardation of full-system capability at full load. This seems adequate, and takes account of future improvement.

In tests, distance is measured from where the pedal is hit to where the car stops. Car makers object to this, because of a time lag when you hit the pedal until the brakes begin to work (brake-system response time). The standard is intended as an incentive to minimize the lag—but instead, auto makers want an allowance for it, in terms of longer stopping distance. General Motors suggests a build-up time of 0.7-1 second, with varied decelerations to suit various vehicles.

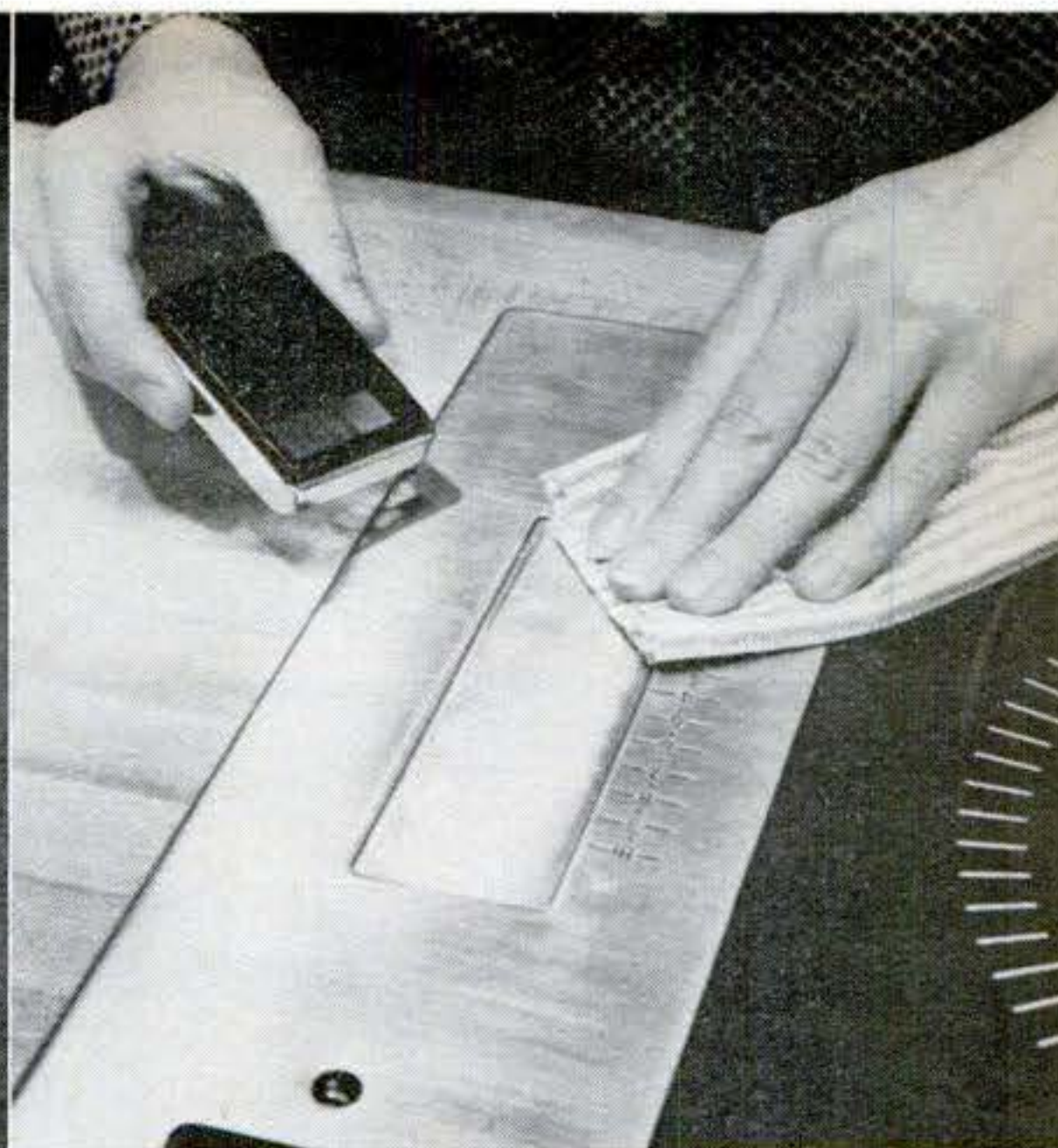
One full second? If you drive a GM car with power brakes, you've experienced it. The booster just can't keep up with your demand. This is critical in heavy traffic. But others support GM. British Leyland says: Modify requirements to allow 0.36- to 0.54-seconds build-up time. That's a lot better than GM's numbers, but you could argue that any allowance decreases the incentive.

But stopping distance, if the most important, is only one aspect of brake performance. DoT also proposes severe tests for fade resistance and water recovery. They are still under dispute. So are rules for stopping distance with inoperative power assist.

Now you see why we have to wait for brake-performance standards to come into effect. First, industry and DoT must come to terms on definitions and feasibility. If new equipment is necessary, the industry must be given time to test it and gear up to make it.



Don't try this on your stove—not unless you have fire insurance. But this range top merely gets warm, and that's only from heat being given off by the pot.



Heat-control knob simply lifts off for easy cleaning. Permanent magnets do work of mechanical linkage.

Pot Gets Hot While Stove Keeps Cool

By **WILLIAM J. HAWKINS**

PS Electronics Editor

The hottest idea in home ranges happens to be cool.

This strange-looking counter range contains no heating elements whatsoever, but, says Westinghouse, will cook your dinner better than ever before.

That's because the new CT-II Cool/Heat range induces heat only in the pot, and not in the range itself. Believe it or not, all the cooking is done with a magnetic field.

Done with mirrors? Not quite, but just as tricky. Westinghouse has taken advantage of a property of inductors that, until now, was considered a nuisance.

The problem is heat. If you've ever touched the power transformer in your TV after it's been on for a time, you're already aware of it.

The transformer, an inductor, is basically two coils of wire. The first coil, the primary, uses the AC line current to set up an electromagnetic field. This field is then induced or generated around the wires of the other coil, the secondary. In theory, all the energy from the primary coil will transfer to the secondary.

In practice, however, not all the energy from the primary coil reaches the secondary winding. Some is induced in the material that makes up and surrounds the coils. This energy creates eddy currents that produce heat—usually a waste of the power input. So inductive components are

normally designed to minimize eddy currents. Westinghouse, however, *maximizes* them.

Four separate electronic oscillators (one for each heating area) produce a 25-kHz AC signal in each of four toroid coils mounted just below the ceramic cooking surface. When a cooking utensil is placed directly over the coil, a magnetic field is induced in it. The pot, made of steel and aluminum, is specially designed to generate maximum eddy currents, for maximum heat. The ceramic stove top, of course, is nonmagnetic. It does warm up somewhat, but only because of heat conducted from the pot.

Heat control. It's accomplished by varying the intensity of the field. Each heating area is individually controlled by a sliding knob. But there is no mechanical linkage between the knob and the variable potentiometer that controls the circuit. Westinghouse gets another "A" for clever design.

Each control knob contains a small permanent magnet. On the underside of the range surface, a second magnet links with the control electronics. As you slide the knob and top magnet back and forth to adjust the heat, the bottom magnet is dragged along with it and adjusts the circuit. The knob lifts off easily for cleaning; there are no dirt-catching holes or slits in the range top.

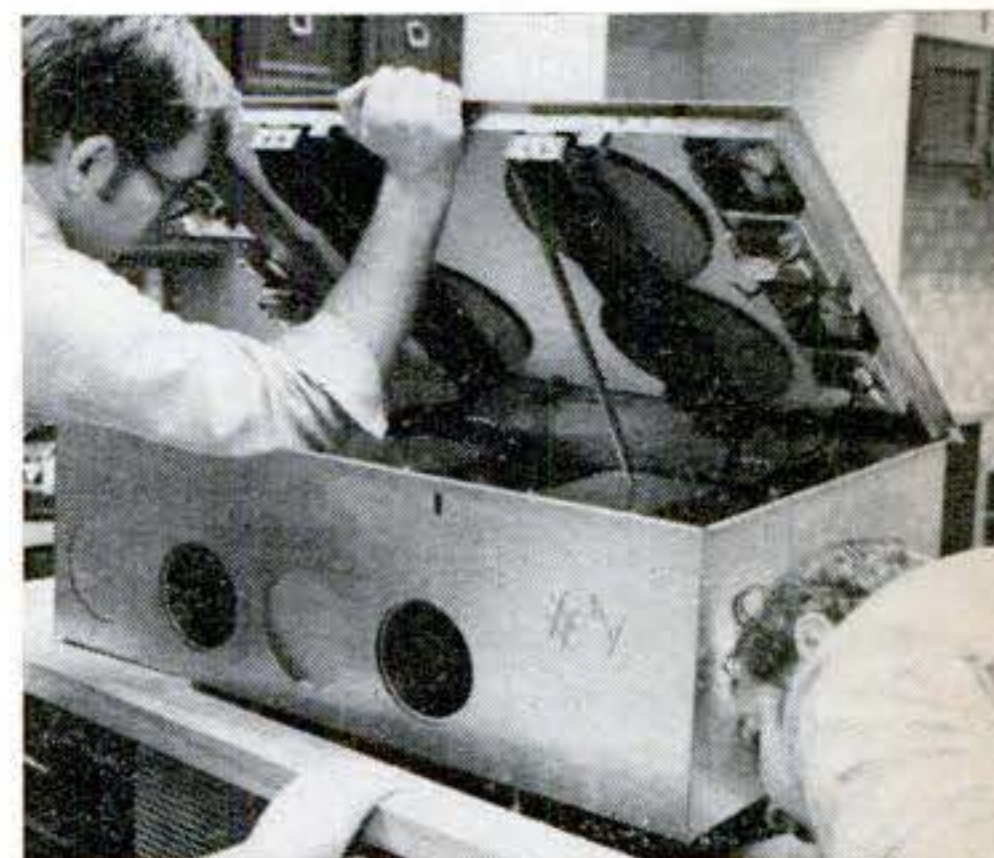
Servicing problems have been minimized by designing the CT-II in modular form. If something goes wrong, the serviceman just pulls out the bad circuit and pops in a new module. Each heating area contains

its own set of electronics, so if one section fails, you can rely on the remaining three until the unit is serviced.

If you remove the pot, but forget to remove the power, a built-in safety circuit takes over to turn off the range. Also for safety, the magnetic field is kept very close to the range surface. If you lift the pot $\frac{1}{8}$ inch from the top, for example, there is a 25-percent reduction in power.

Operating voltage is the same as in conventional electric ranges, but faster thermal response and greater heating efficiency make the Cool/Heat range cheaper to use.

However, the initial cost is considerably higher. You can order the CT-II through a local distributor or directly from Westinghouse, in your choice of black or white ceramic top, for \$2,500. A 10-piece set of the special cookware (necessary for proper operation) is included. PS



Modular construction simplifies servicing. Bottom air fans cool internal circuitry.

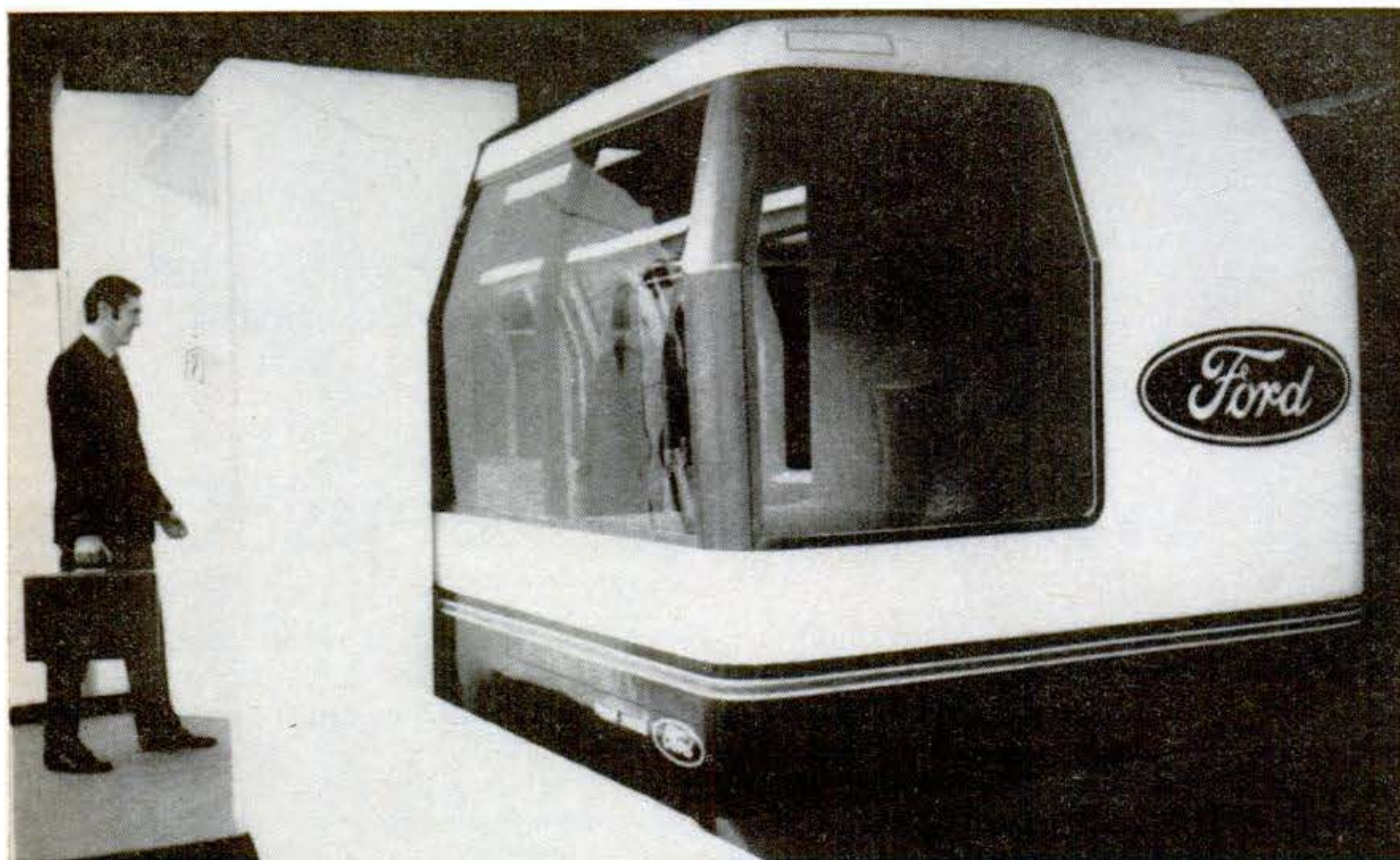
What's New

A PICTURE ROUNDUP OF NEW PRODUCTS AND DEVELOPMENTS



Radio horn

Some day in the future, when the driver behind you sounds his horn, a buzzer will go off in your radio speaker. That's what Pontiac engineers are working on with this electronic radio horn—an answer to the problem of closed cars and loud stereo. Range: about 600 feet.



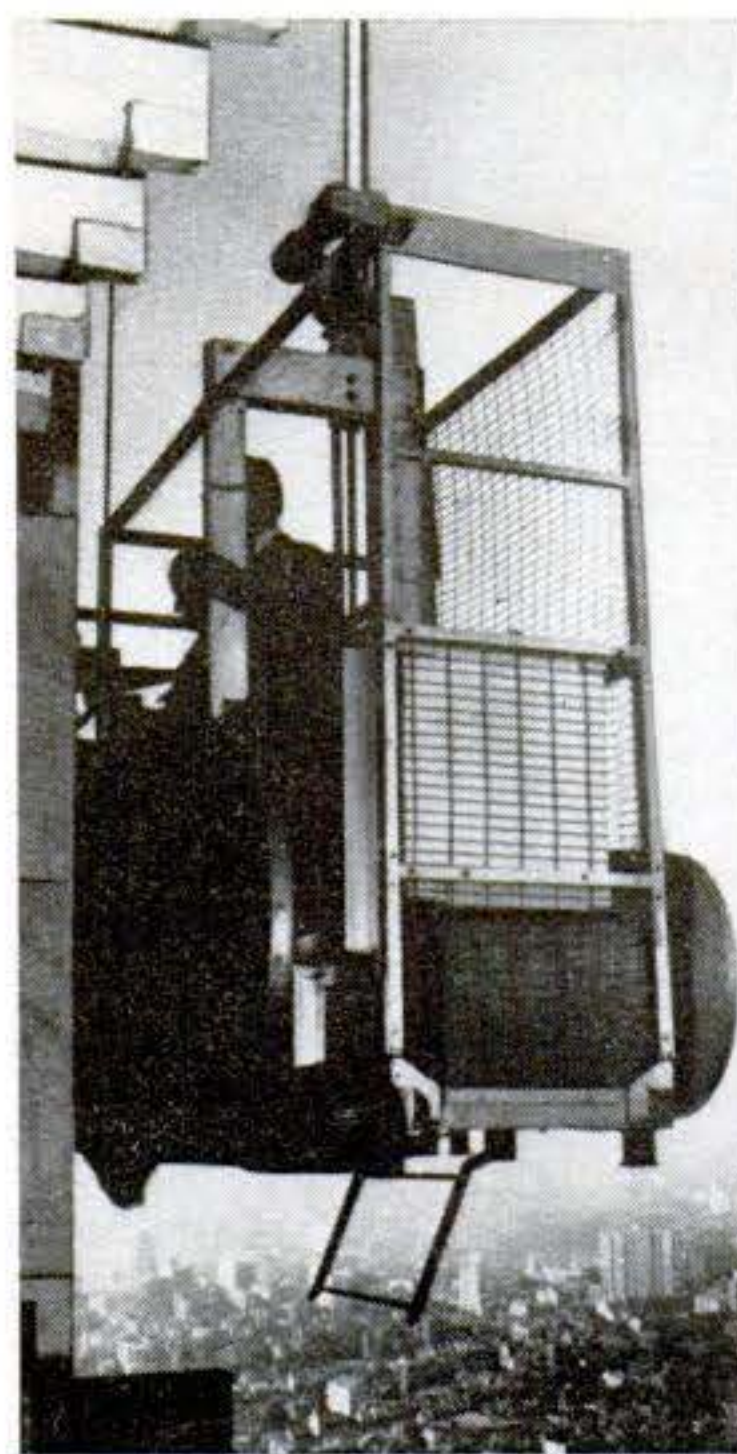
People mover

Here's a better idea for moving people short distances in and around congested areas. Ford is setting up its automated ACT (Activity Center Transportation) system, for easy-on, easy-off mass transportation, at Transpo '72, the international exposition starting May 27.



Testing a glass-domed submersible

That's a 44½-inch-diameter glass hemisphere streamlining the bow of the Navy's latest submersible, Deep View. The 300-lb. borosilicate glass dome, made by Corning, will give observers wide-angle views down to 1,500 feet—over twice the depth possible with plastic domes. Sea trials down to 50 feet will check controls in the cigar-shaped, two-man vehicle. Then the six-ton Deep View will dive deep. Five motors and propellers allow speeds up to five knots fore and aft, two knots vertically.



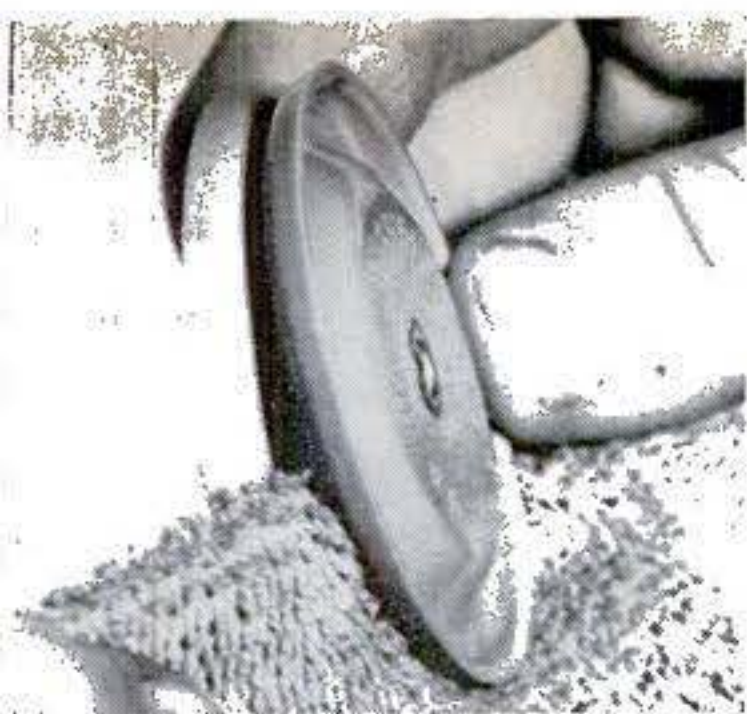
No-sway cage

How do you hold a maintenance cage against a wall? Two fans on this rig draw air through pads facing the wall. The thrust prevents the cage from swaying, while pad bristles allow free vertical movement. It's made by E. W. Cox Pty. Ltd., Artarmon, Australia.



Plastic oil pouch

Bag of oil, please? It's a neat way to add a quart. Just drop a plastic oil pouch into a dispenser equipped to pierce it. B. F. Goodrich thinks this experimental Tuftane container could cost two cents less than present containers. One holdup: Cans can be filled faster than plastic pouches.



Clothes disks

Wooden clothespins may crack, splinter, and decay, but not these colorful Solardiscs. Their plastic construction can't snag delicate fabrics—yet they'll grip a turkish towel easily. They're \$1 a dozen from R. T. Duarte Co., South Merrimack, N.H. 03054.

Roomy Pinto

There's lots of cargo room—60.5 cubic feet—in the new Ford Pinto station wagon. Fold down the rear seat and you can carry 69.2-inch cargo lengths. Width between wheel houses is 42.5 inches. The wagon's braking system has disks in front and drums in the rear. Horsepower is 86.



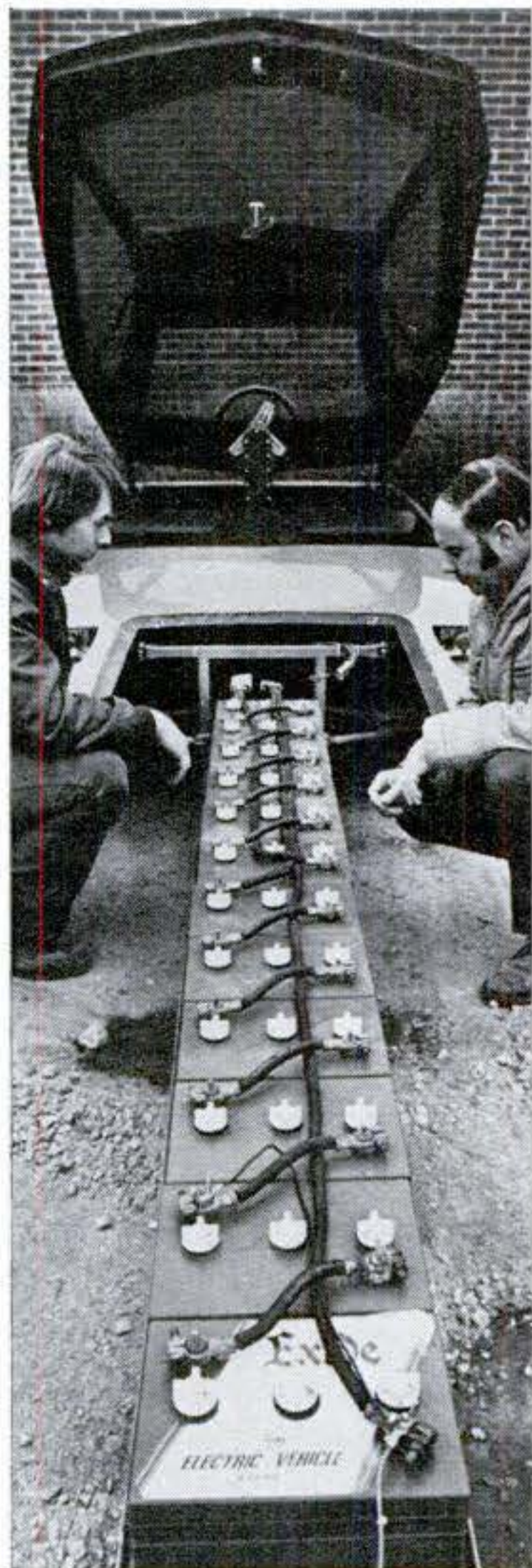
Kid-proof Cricket

Here's Plymouth's new four-door subcompact Cricket station wagon. It's 166.4 inches long, 62.5 inches wide, and offers 60 cubic feet of cargo room. Power plant: a four-cylinder 91.4-cubic-inch standard engine. Child-guard door locks provide two-door security in a four-door model.



Tree gun

Think you could plant 2,500 trees in a day? You could with Georgia-Pacific's new inertia gun. Plastic "bullets" carrying the growing seedlings are fed into a tube-like "gun" and forced into the ground. New technique replaces helicopter reseedling for faster growth start and lower mortality.



Electric spine

Batteries in this experimental electric car run lengthwise through the chassis. They'll operate the vehicle's eight-hp motor for 150 miles—up to 60 mph—on a charge. A slideout battery set installs in five minutes. McKee Engineering Corp., 411 W. Colfax St., Palatine, Ill. 60067.



Coming up: a no-work kitchen of the future

Everything's electronic in this futuristic kitchen—a series of modules that separate work functions. On top: a communications center with four TV screens to keep track of all areas around the house, plus phone, radio, intercom, and recorder. Below: the laundry center, with labeled pushbuttons. Just press the appropriate button; a buzzer sounds when the job is done. There are also cooking, cleanup, refreshment, and environmental modules. They're all experimental, but—says Westinghouse—not too far from the production line.

What's New



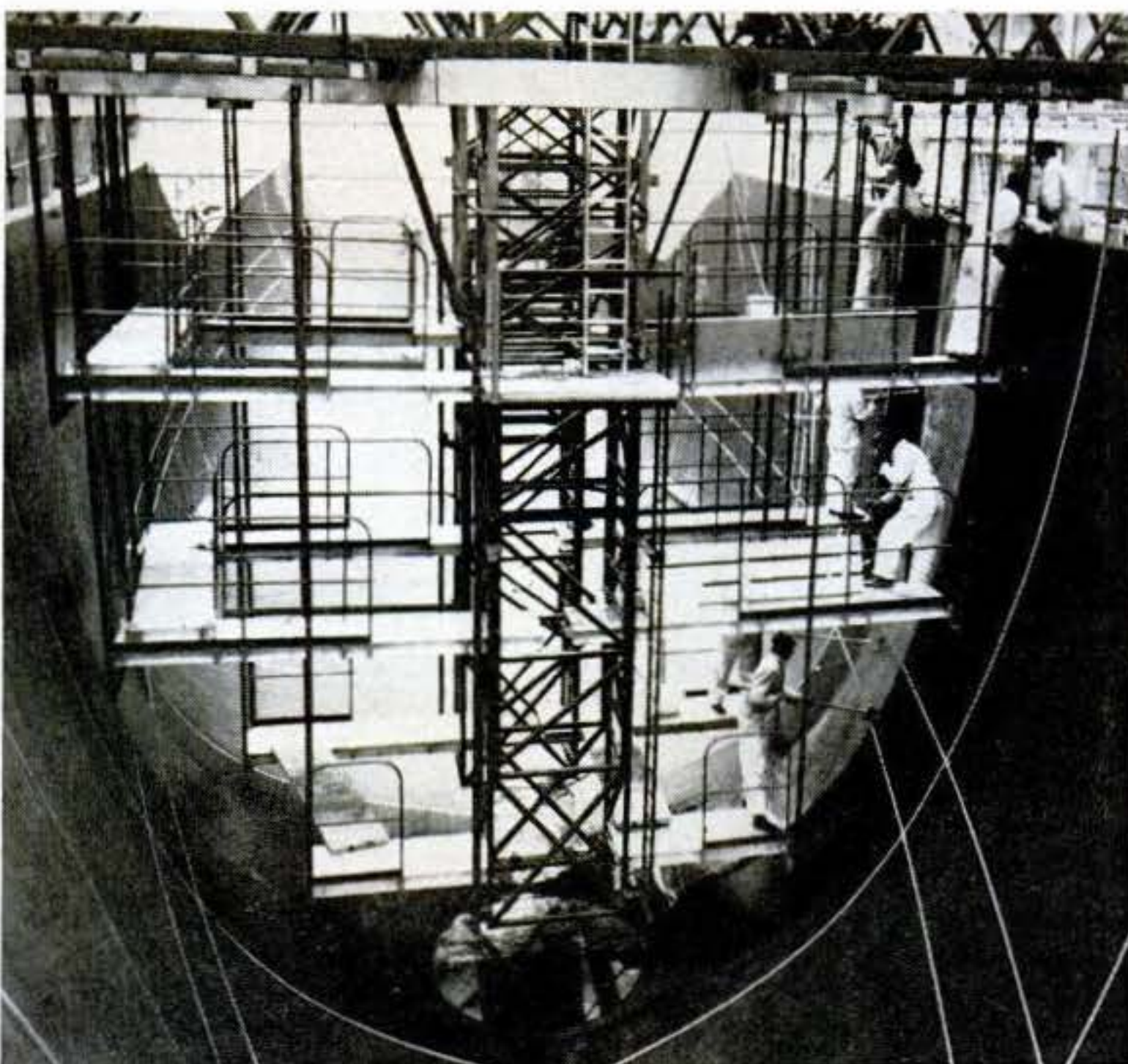
Powered kite

Strap a fan on your back, hang on to a hang glider, and you're off! Californian Bill Bennett flies about 1,000 feet up in the blue at a speed of 30-35 mph. He gets his push from a 12-pound, 12-hp McCulloch two-stroker. Longest flight to date: three miles.



Rooftop hitch

Here's a far-out idea: a trailer and car-top hitch that, claims the maker, Harmon Industries, Warrensburg, Mo., makes for easy maneuvering. The 18-foot rig, a prototype, swivels on a hitch secured to the car like a luggage rack. The car can turn 360 degrees under the trailer without touching it.



Plastic ship

World's largest plastic ship—153 feet long and 450 tons—HMS Wilton is shown a-building at Portsmouth, England. She'll function as a nonmagnetic mine hunter. Structural members and engine mounts go in after the fiberglass shell, laid up in a steel mold, is complete.



Sporty amphibian

Want to tow your motorcycle to the back country? This Italian Bertone vehicle does it. The tailgate becomes a ramp. Want to take a spin on the lake? Clamp an outboard to the rear door and take off. A three-cylinder Suzuki engine is built into the left side. Radiator is on the right.



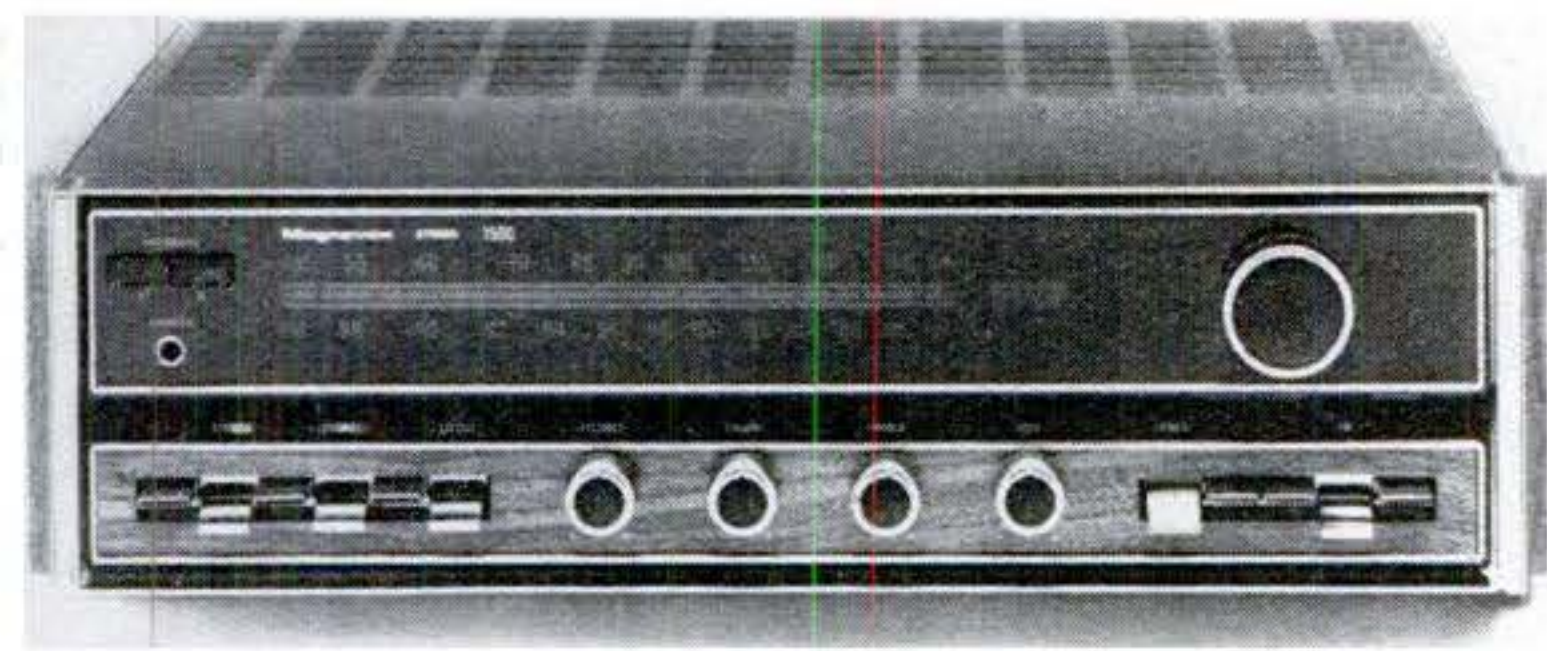
Diesel outboard

Out goes the engine room on this barge! In its place is a 300-hp diesel outboard, quickly transferable from boat to boat, with a prop that swings up at any angle for shallow-water use or repair. The U.S. Navy has ordered 32 units, says the maker, Maritime Industries, Vancouver, B.C.

What's New IN ELECTRONICS

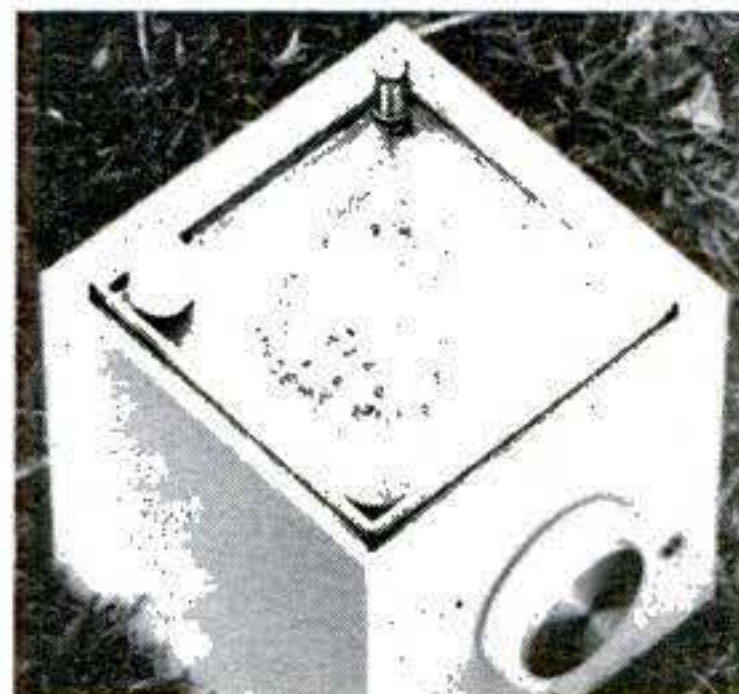
Lightweight

High output, low weight—that's the claim for this new Concord cassette recorder. It weighs only three pounds, yet offers features of expensive units: pushbutton controls, remote-control mike, automatic level control, 2 1/4-inch speaker. Price of model F-21: \$35.



Big-power amp

Look who's into the audiophile hi-fi component business: Magnavox. And here's their new model 8896 150-watt tuner/amplifier with frequency response of 15-20,000 Hz, an indicator light that warns of overheating, and pushbutton function selectors. Available extra: digital tuner readouts.



Compact cube

Can't watch TV but want to listen to it? The Video-Voice offers VHF sounds so you can keep up with your favorite TV programs—plus FM for the times when you want music. Price of the five-inch battery-powered cube: \$29.95. It's by Concept Plus, 12509 Beatrice St., Los Angeles, Calif. 90066.

Power antenna

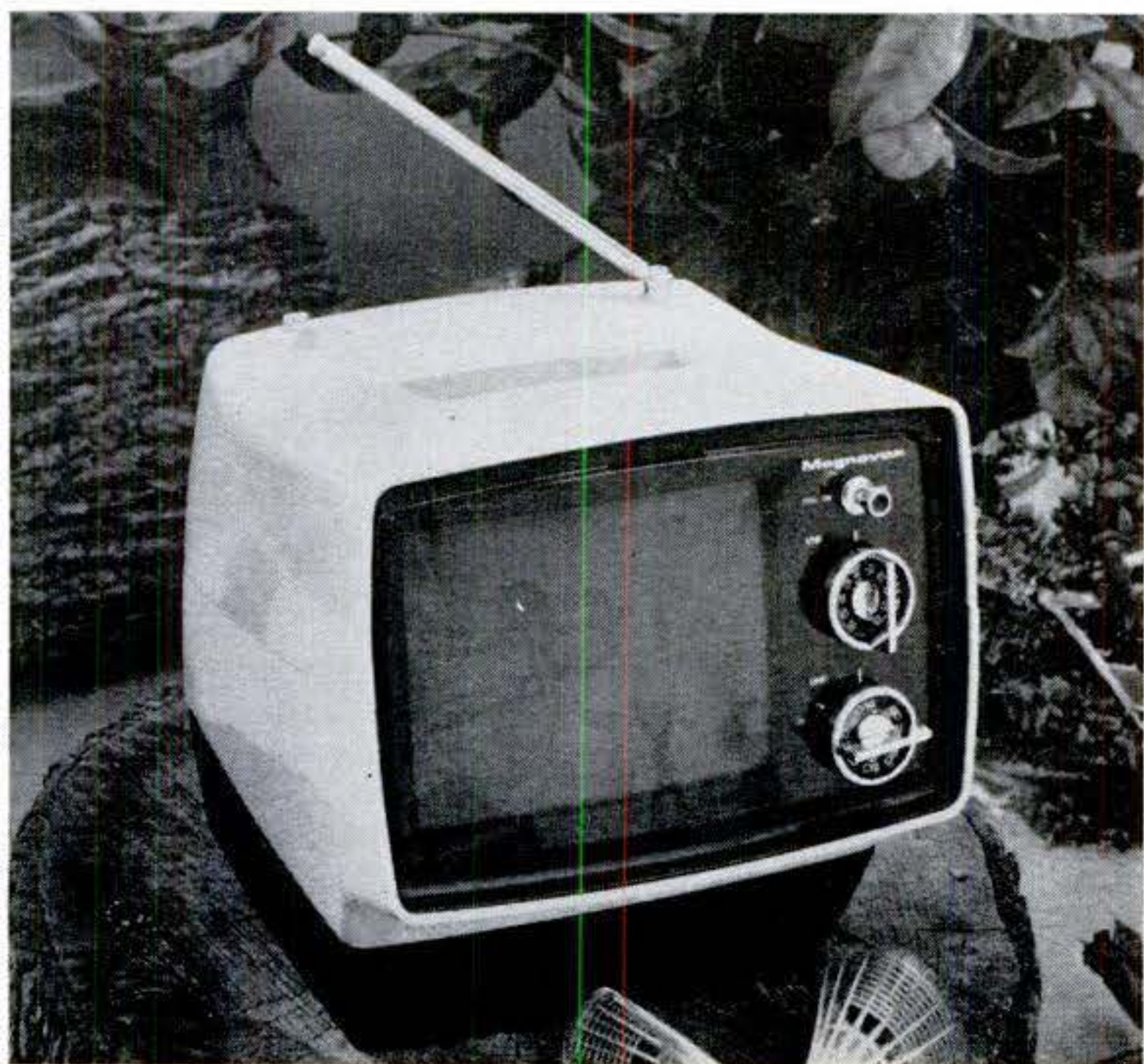
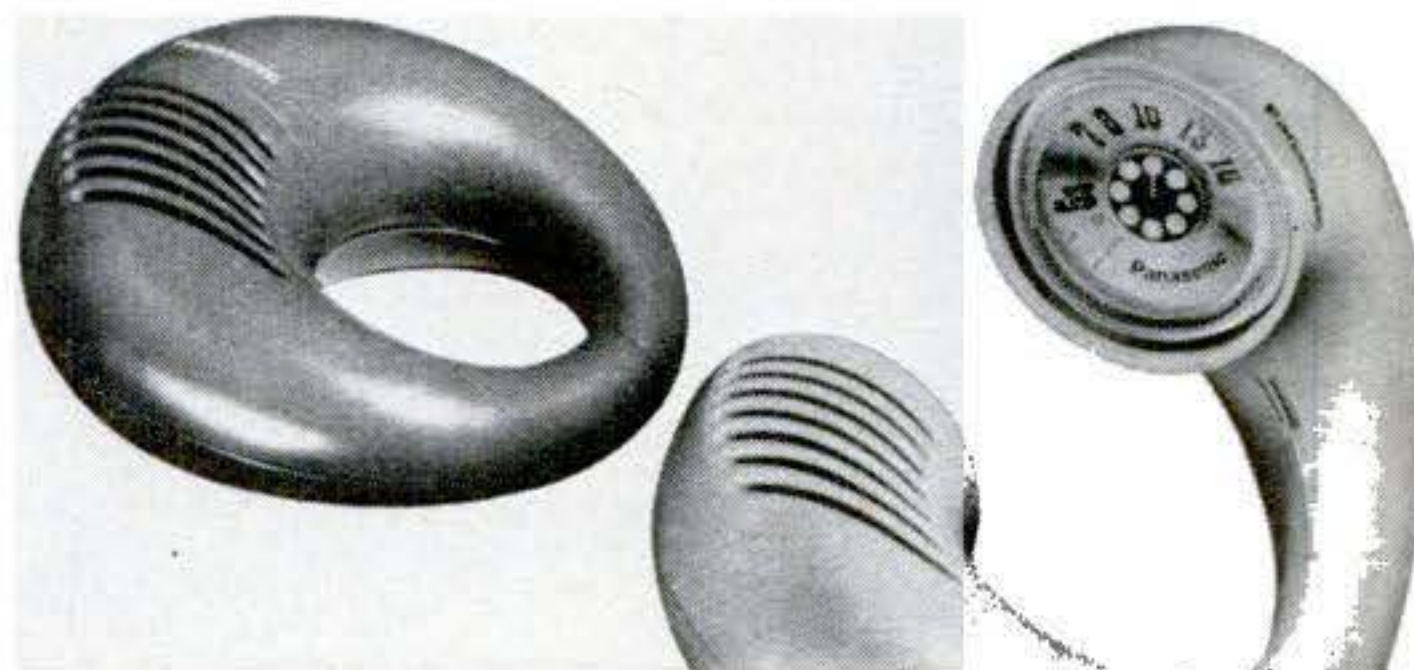
A built-in transistorized amplifier boosts picture power seven times compared with non-amplified antennas, claims Channel Master, maker of the new Chroma antenna. It's said to cover all 82 VHF and UHF channels, and FM, too. Price: \$24.95 and \$29.95 for two models.

Add-on transmitter

Any radio within 300 feet can be a remote speaker for your hi-fi. Just plug the Remota into your amplifier, and it broadcasts on a preset blank spot on the radio band. Batteries power the \$24.95 transmitter. Mogull, Inc., 1910 Sunset Blvd., Los Angeles, Calif. 90026.

Bracelet radio

Wear it on your wrist or (with a twist to open it) set it on your desk. It's Panasonic's R-72 AM radio, with built-in ferrite-core antenna. It comes in colors, too: red, white, blue, yellow. Price: about \$13.



Outdoor TV

This b&w TV sits on its battery pack—an option that lets you take it along for camping. (Or, with an adapter, you can use your car or boat battery.) The seven-inch Magnavox weighs 13 pounds without pack, is about a foot square, and comes with a sunshade for glare-free viewing.

Four-channel kit

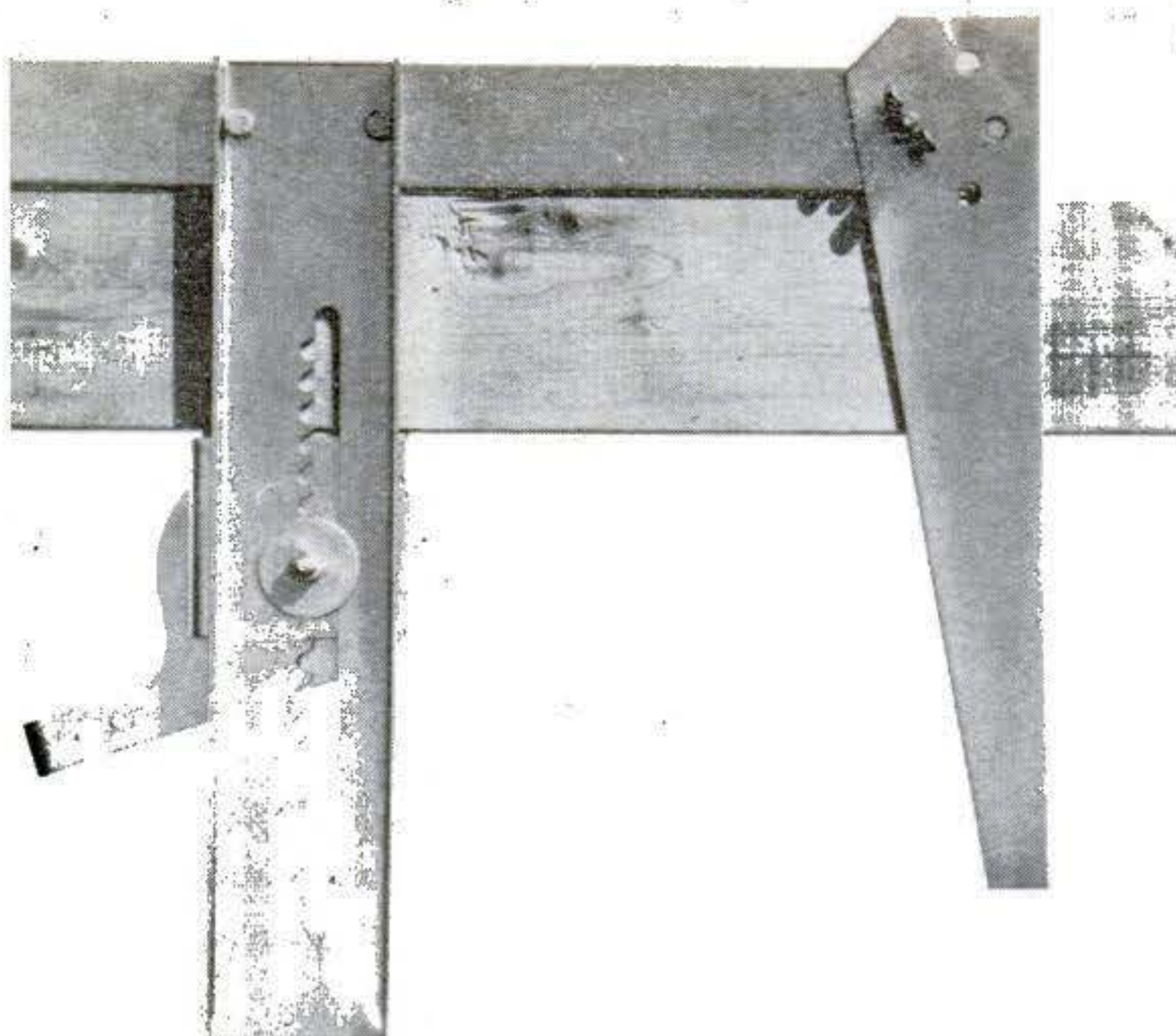
Solder it together and you get four channels of listening with this new kit amplifier. It offers four modes (mono, stereo, and discrete and matrixed four channel), 260 watts of power, and 20 input-level controls. AA-2004 is \$349.95 from Heath, Benton Harbor, Mich. 49022.

What's New IN TOOLS



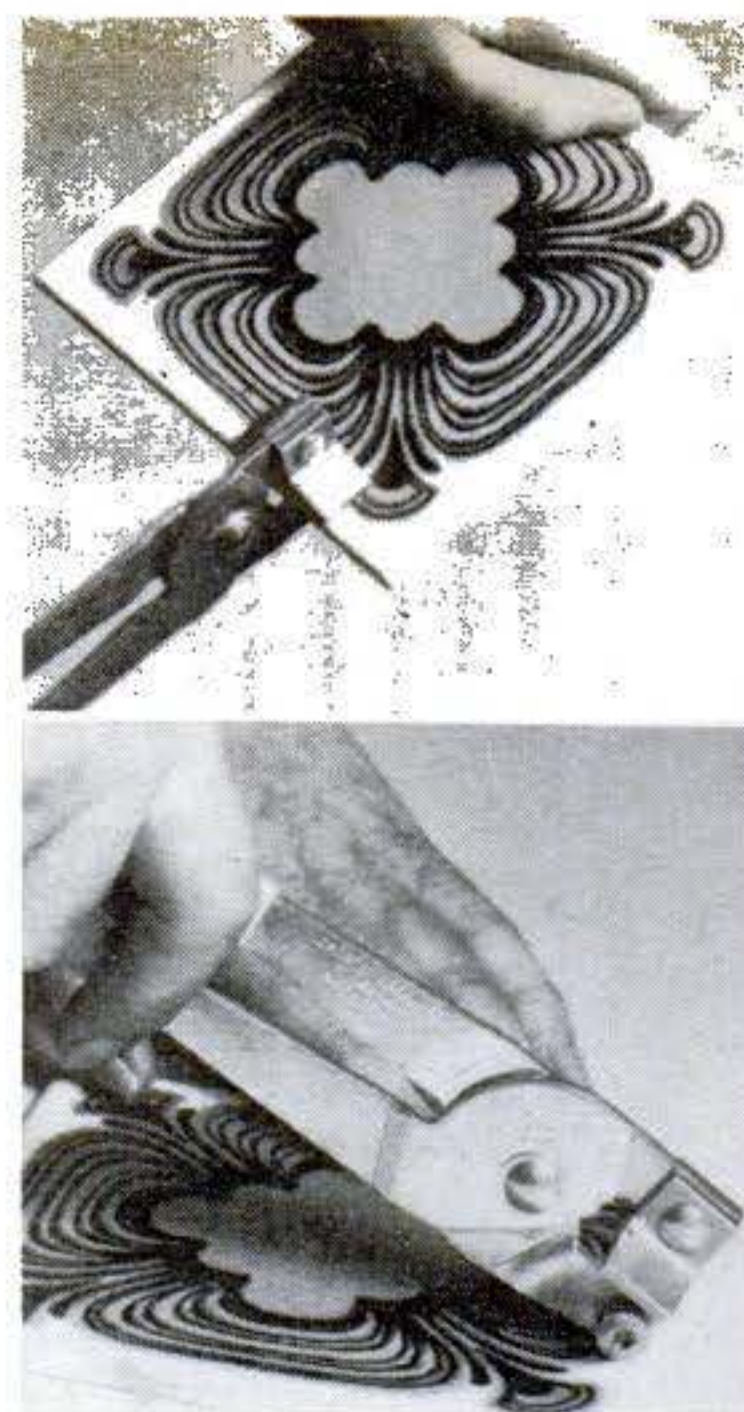
Do-it-all drill press

Ward's new 17-inch Powr-Kraft drill press has some nice new features: solid-state speed control, one-horse motor, auxiliary router/shaper spindle with speeds up to 20,000 rpm, 180-degree head rotation, and a half-inch chuck with chuck-key safety lock. Price: \$250.



Cutter guide

You get perfect right-angle cuts on boards up to 10 inches wide, perfect 45-degree miters on boards up to six inches, with your cutoff saw and this clamp-on guide. The Chapco Saw Guide is made by Chapco, Denlar St., Chester, Conn. Price is \$10.95.



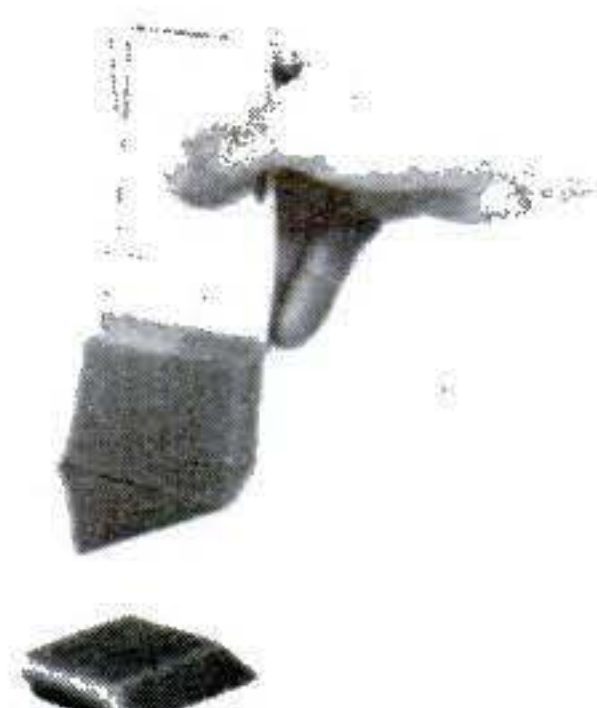
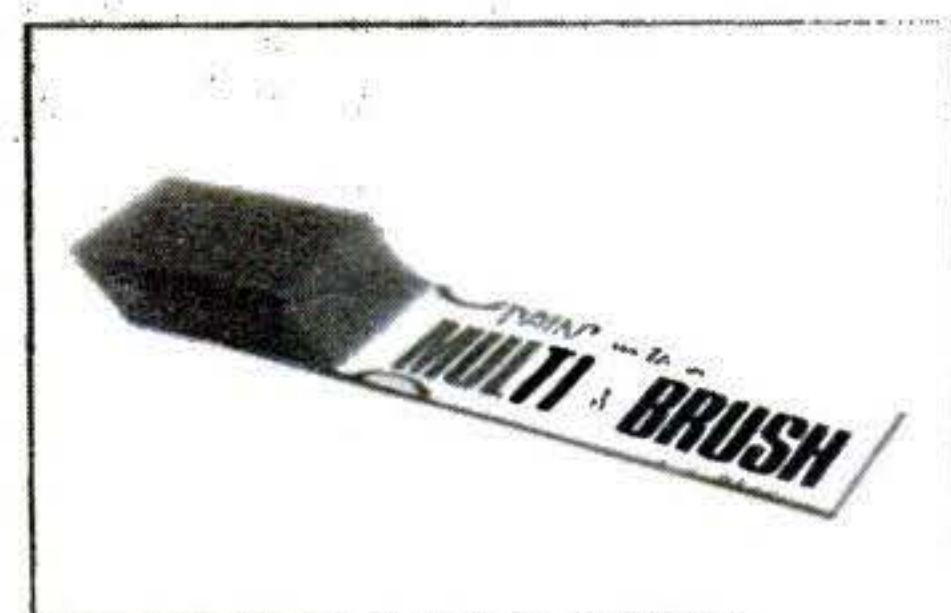
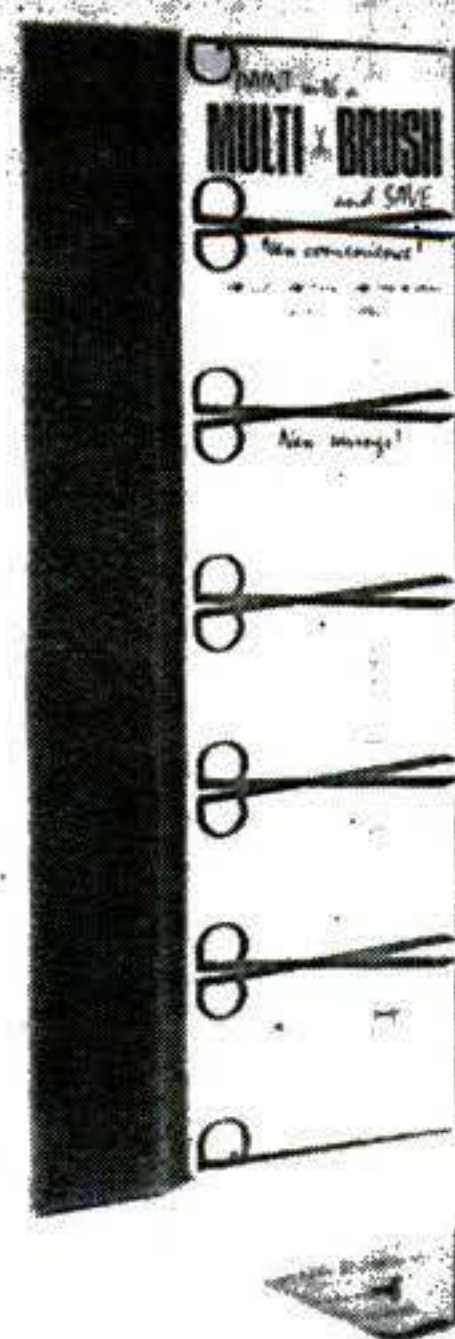
Easy cutting

You can cut curves in ceramic tile with this new British tool. Score the line with the cutting wheel (lower photo), snap off the scrap with the special winged jaws. Opporto Ceramics, 324 Meanwood Rd., Leeds, LS7 2JE, England, makes the tile and glass cutter.



Stalked caulker

No more bending, no more stretching to caulk those hard-to-reach spots. Speed Caulker's stalk does the reaching for you. A 40-incher is \$25, a 60-incher \$27 from Oak Grove Enterprises, Foristell, Mo. 63348. Both dispense caulk, asphalt cement, and drywall adhesives.

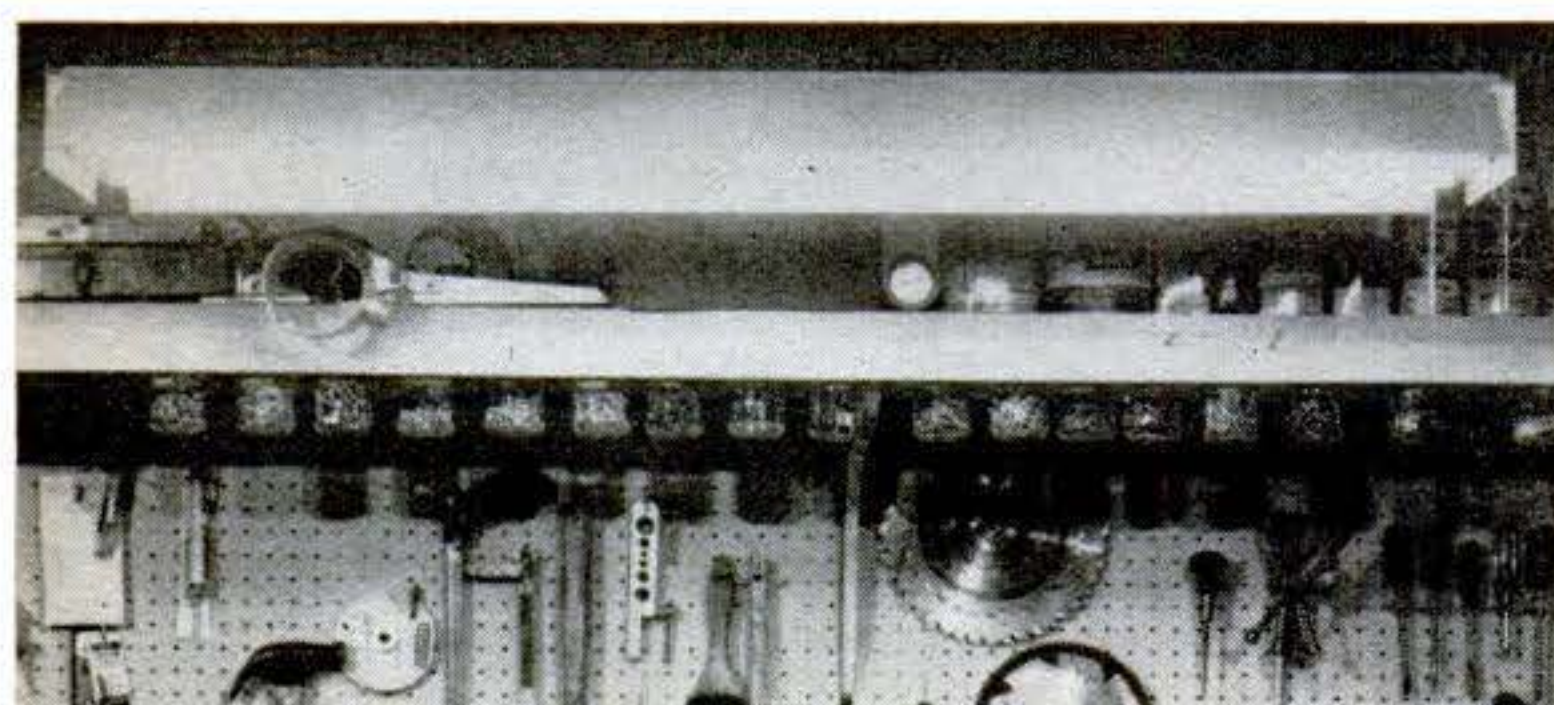


Foot of brushes

Foam paintbrushes by the foot? Right. You just snip off a brush—any width—use it, and throw it away. A two-incher costs less than the turps it would take to clean it. Multi-Brush is \$1.49 a foot from The Design Center, 891 Prospect Heights, Santa Cruz, Calif. 95060.

Bench lighter

You're a better worker if you can see what you're doing. That's the idea behind this four-foot workbench light. It uses 40-watt lamps, comes with the yokes and chains you need to hang it over your bench. It's made by Celotex.





Up-tight wedge

Here's a plastic wedge that really holds a hammer head in place. If the handle dries out and shrinks, the wedge—compressed under 5,000 pounds' pressure during installation—expands to keep everything tight. Vaughan's "living wedge" is used in Value brand and Double Duty hammers.



Easy cleanups

Tray cleanup got you down on rollers? You'll like these throw-away aluminum tray liners by Alcan. They're made to fit a 9" by 14" tray (for 7" rollers) and are lined inside with epoxy to prevent reaction with the paint. A package of three is about 69¢ at paint stores.

What's New FOR YOUR CAR

Gas mask

Like to race? This mask screens out dust, and most gases, to keep your lungs and head clear while you drive. Good for city driving, too, if you have no vanity. Auto Mask is \$22 from Survival Associates, Box 8, Old Chelsea Station, N.Y., N.Y. Comes with two filter cartridges.



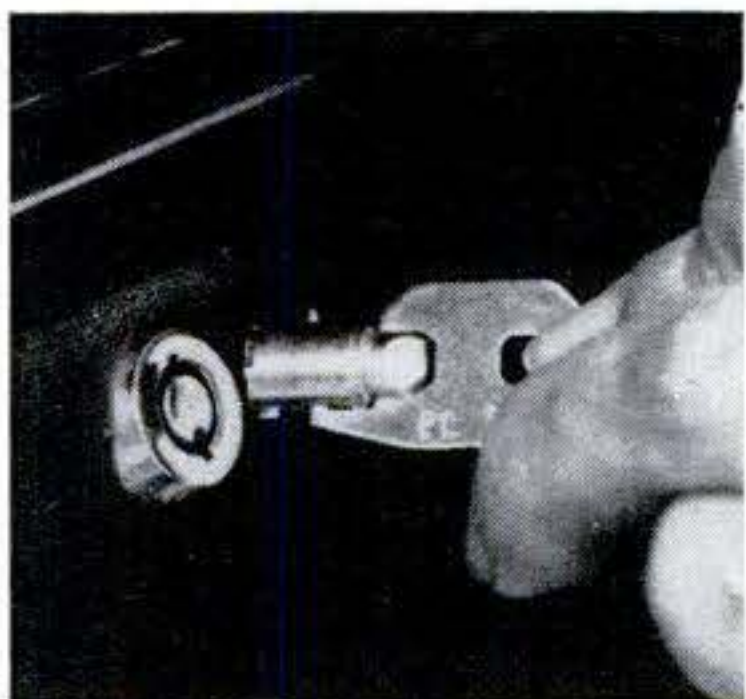
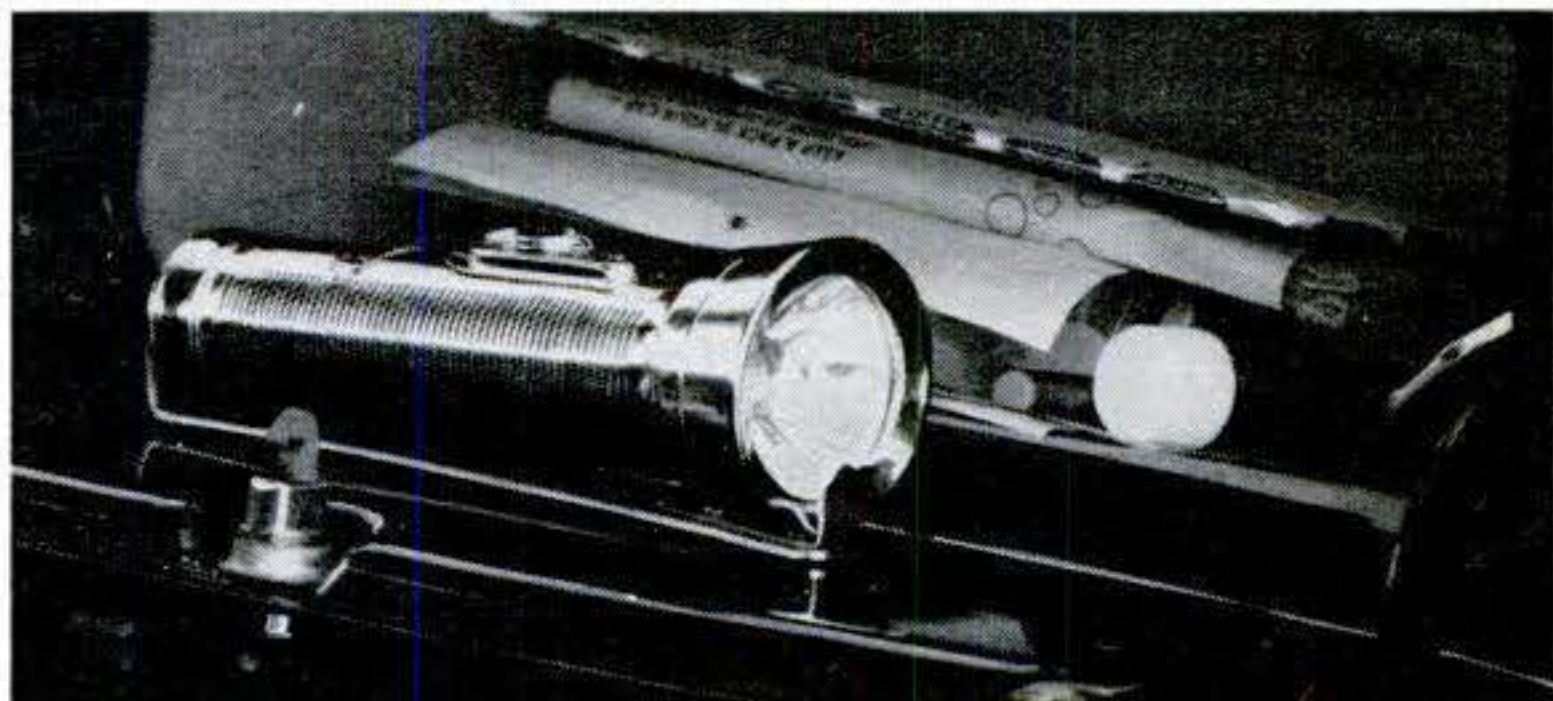
Compressor cutout

Your air-conditioned car overheat at idle? This electric clutch will automatically cut out the compressor at any speed you set. Result? No more overheating, dieseling, vibration, and stalling. The C5 clutch control is \$20 plus mailing from Power Technology, Box 4403, Little Rock, Ark. 72204.



Auto light

Keep the Hy-Lyte Ni-Cad flashlight in its mounting clip/charger between uses and you'll always have light. It installs in any vehicle with 12VDC electrics. Technical Devices and Research, 16 Maple Rd., Chelmsford, Mass. 01824, makes it. Price: \$18.50.



Brake lock

A good car thief can foil a steering-column lock in 15 seconds. Sta-Lok-It tries a different approach to foil thieves—it locks the braking system. Installation is easy. Price? \$50. Maker? Sta-Lok, 1647 Monrovia Ave., Costa Mesa, Calif. 92627.



Hood/trunk lock

Turn off your ignition and this lock automatically seals the trunk or hood. A pair protects both front and rear. The Wolo Undercover Lock is sold in auto-parts stores, complete with instructions and mounting hardware. Wolo Mfg., 37 Jefry La., Hicksville, N.Y. 11801.



Adjustable shocks

Sometimes your camper's loaded, sometimes it's running light. These new shocks let you adapt. Add air for heavy loads, let it out for light. An optional dash unit enables you to make adjustments from the driver's seat. Air Adjustable Shocks are by Thruway, c/o Goerlich's, Box 537, Toledo, Ohio 43693.

What's New IN OUTDOOR RECREATION



Cold holder

This ice chest will keep ice up to three days. The secret: urethane-foam insulation (instead of polystyrene). There's a removable food tray inside, and the lid of the chest becomes a serving tray when turned upside-down. Price: \$17.95. Maker is Gott Mfg., Box 652, Winfield, Kans.

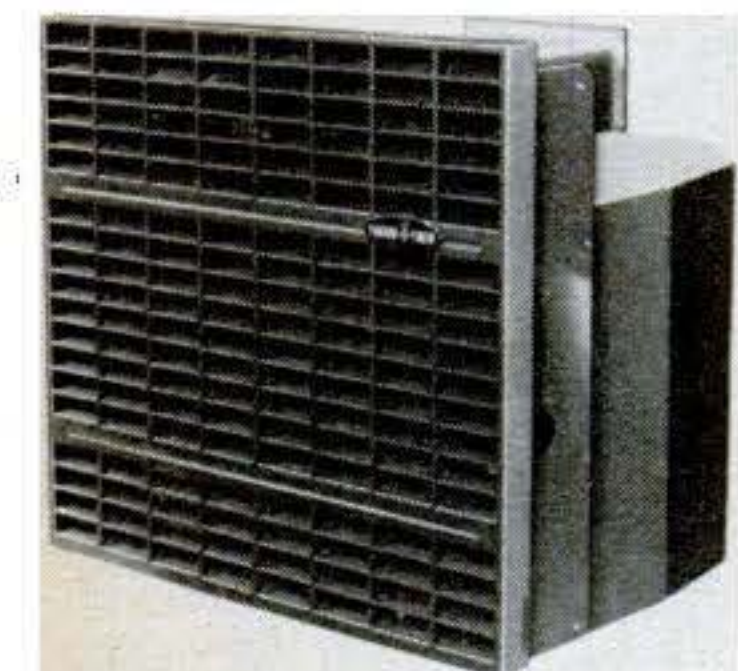


Small-game cartridge

Just the ticket for small-game hunters: a .22 magnum cartridge that won't mutilate the flesh. A special bonded jacket keeps it from deforming on impact. The .22 WMR cartridges come in hollow or solid point. Box of 50: \$2.95. They're made by Omark-CCI Industries, Lewiston, Idaho.

Lube kit

Grease your own wheel bearings? You bet—with this three-tool home lube kit. It has a pump-type oiler, grease gun, and an oil-can spout that fits standard oil cans. The \$9.95 kit comes with wall brackets to hang the tools in your garage. Tempo Products, 6200 Cochran Rd., Cleveland, Ohio 44139.



Twin heater

Need a heater in your RV, but you're cramped for space? Then Therm-O-Twin space/water heater may be for you. It has quick connections and uses only one vent. There are two thermostats: 15,000-Btu input for heat, 8,800 for water. Atwood Mobile Products, Rockford, Ill. 61101.



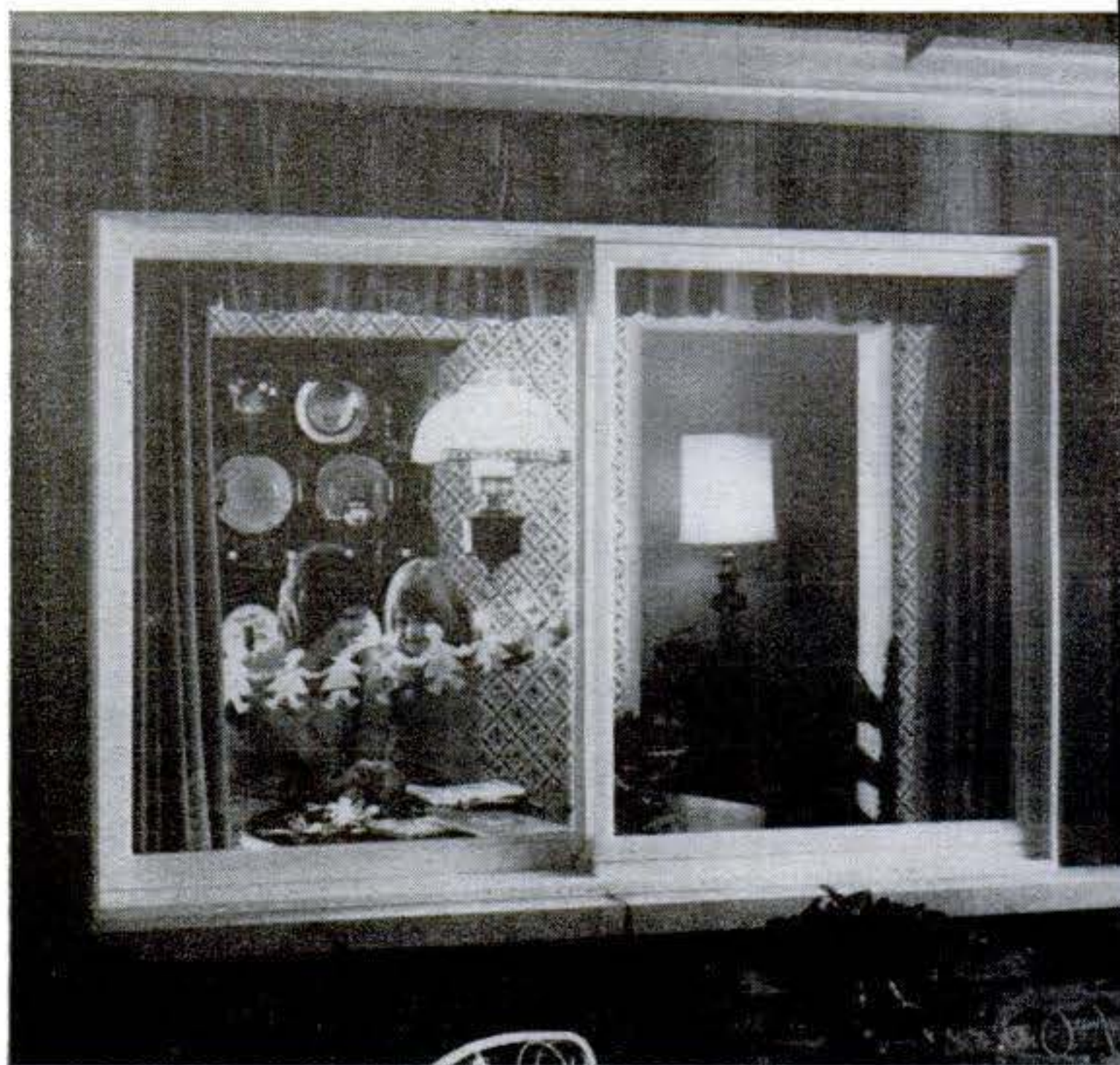
Easy-on rack

Look—no holes to drill to install this bike rack. It attaches to the rear bumper with adjustable clamps; carries two bikes or one mini-bike; fits most cars, pickups, and trailers. Price: \$15.95. Acar Industries, Inc., 4563 Industrial Pkwy., Willoughby, Ohio 44094.

What's New IN HOME IMPROVEMENT

Vinyl-clad window

Tired of painting window sashes and frames? Here's a unit with vinyl cladding over preservative-treated wood—first of its kind offered on sliding windows. Double units have one movable sash; triple units have two. Perma-Shield windows are made by Andersen Corp., Bayport, Minn. 55003.



Surface cement

The man above is troweling Sure-Wall Surface Bonding Cement to the concrete blocks. But look—there's no mortar between the blocks! The reason: fiberglass strands in the cement supply holding power. From W. R. Bonsal Co., Box 38, Lilesville, N.C. 28091.



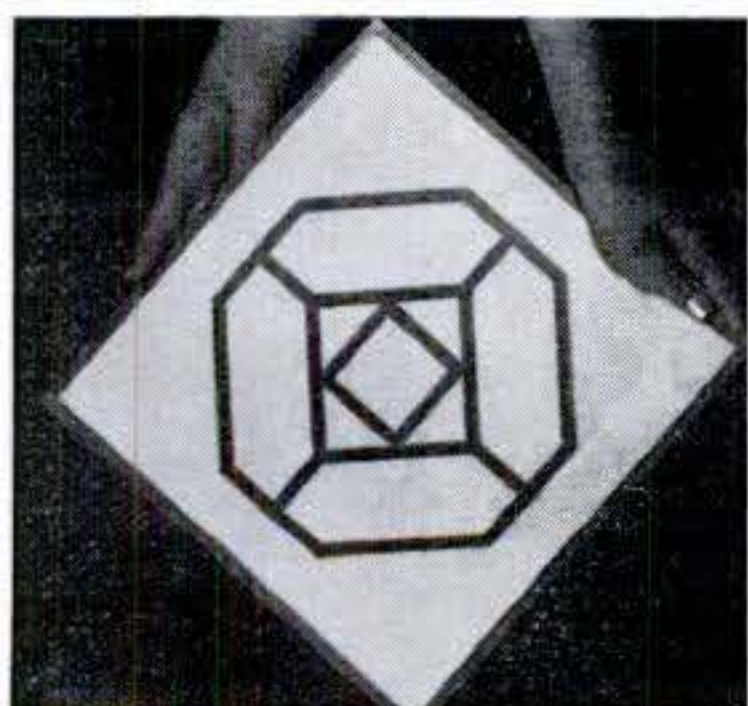
Buoyant pump

That pump above weighs just 35 pounds, yet puts out 120 gallons a minute. And it floats. Set in a pool or pond, it will pump for 1½ hours without refueling. Power for the Pump-R-Buoy is a 3½-hp gas engine. About \$100. Evans Precision Mfg., 320 Locust St., Lancaster, Ohio 43130.



Invisible wires

The gal above is hanging a picture light that uses new adhesive-backed Conduct-O-Tape. The thin wire-embedded tape can be painted over so you never see it. It operates on low voltage only. Kit with tape, connectors, splices, etc., is \$5 from Hobby Hill, Inc., 417 N. State St., Chicago, Ill. 60610.



Geometric tiles

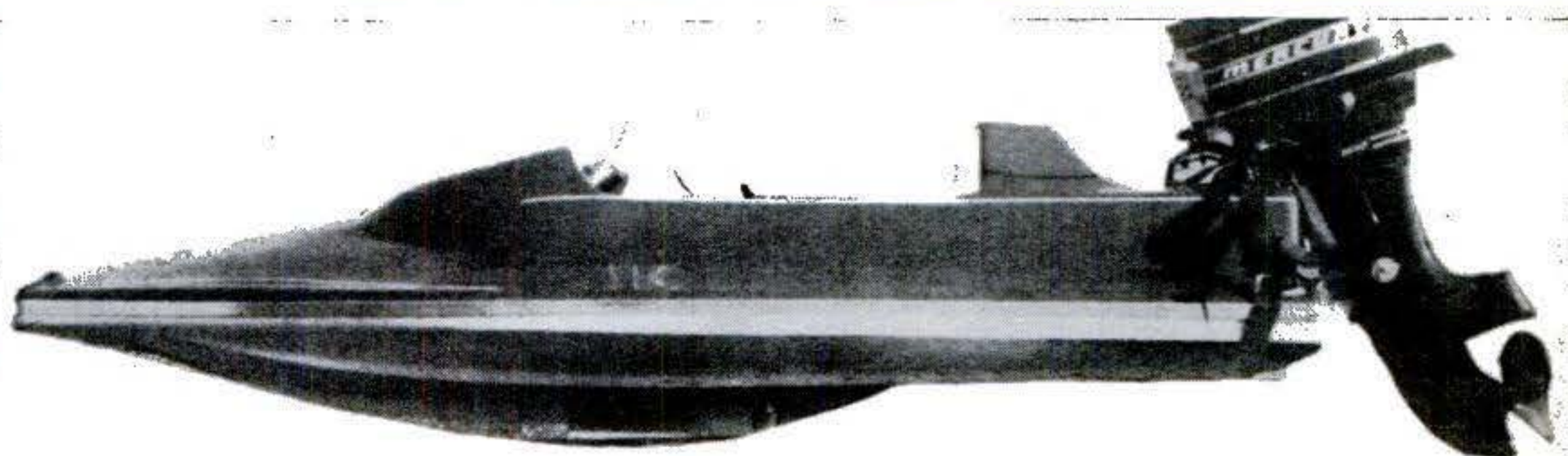
You get a lifetime guarantee against wear with these new Goodyear self-adhesive floor tiles. The Mirada vinyl tiles come in two wood grains and seven colors. And you never have to wax 'em, says the maker.

What's New IN BOATING



Sleek outrigger

Catamaran? No—it's AMF Alcott's new outrigger, the Hilu. The main hull is 14 feet; the float, 10 feet. Capacity is 225 pounds—two youngsters or one heavyweight. Price? \$445. From AMF Alcott, Waterbury, Conn. 06701.



Mini-aquamobile

Hang a 50-hp outboard on the 10-foot Trident I, and watch her go! The little sports boat is a one-seater, has a 49-inch beam, and comes in a choice of colors. Prices start at \$595. Kan-Sun, Inc., Box 5014, Topeka, Kans. 66606.

Doppler speedometer

Here's a marine speedometer with no moving parts underwater—nothing to foul. A transducer under the hull sends out pulses (like those used in radar speed traps) and detects the Doppler shift, which varies as the boat moves. About \$180 in England. Impectron Ltd., 23-31 King St., London W3 9LH.

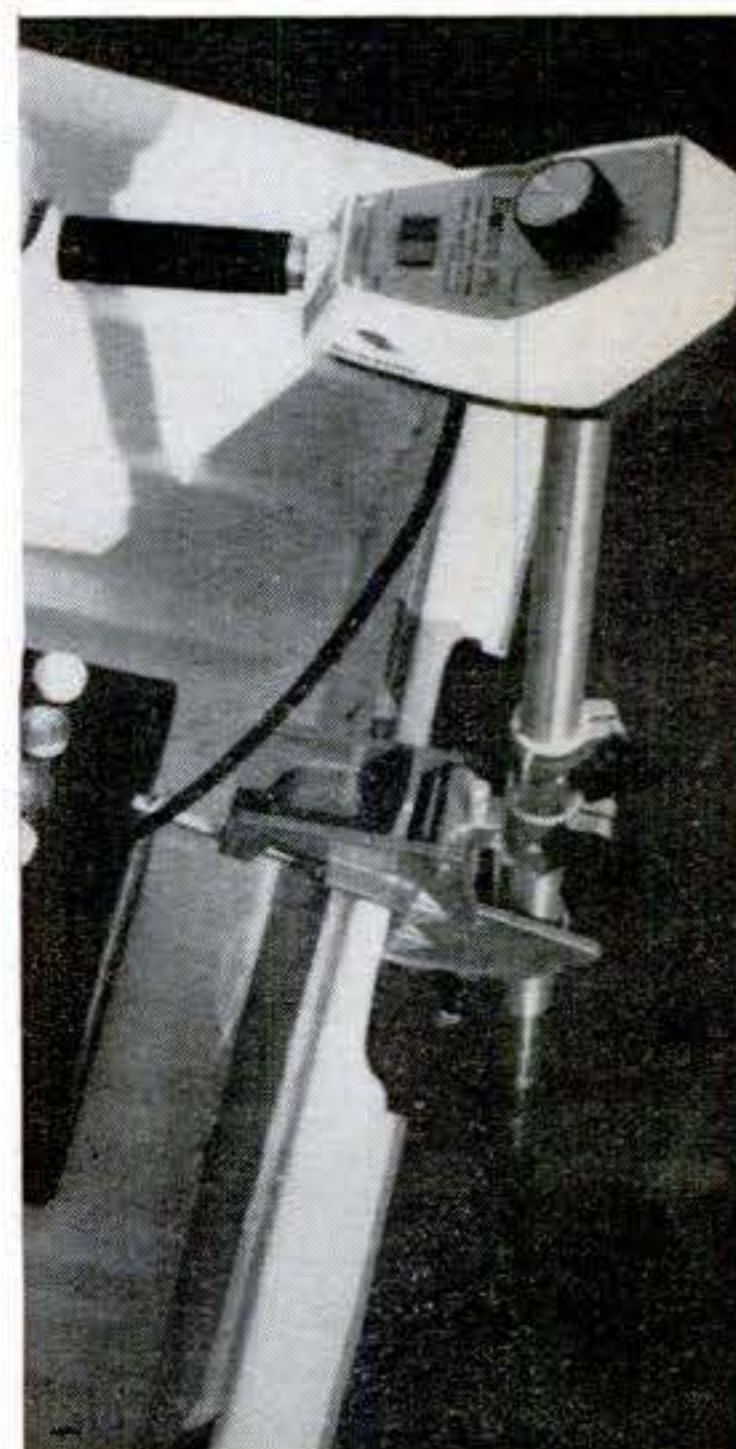


Outboard air drive

Now you can have a mini-air-boat—just like the big ones used in Florida's Everglades. Arrow Drive 800 uses an eight-hp Chrysler engine weighing 55 pounds. It has a 25-inch, two-blade prop. The duct rotates for steering. \$298 from Arrowcraft, Box 700, Pearland, Tex. 77581.

Solid-state troller

Flexibility and light weight—that's what you get in the new Electra Pal Pro Solid State trolling motor. It offers infinitely variable thrust control up to 10 speeds, 360-degree steering. Weight: 16 lbs. Price: \$149.50. Osborn Engineering, 1400 E. Lafayette St., Bloomington, Ill. 61701.



BICYCLE CAMPING—

What you need to know to join the fun



Lightweight bike with saddlebags, and backpacking equipment like this nylon tent, are the keys to successful bike camping.

This summer, pedal your way to a new dimension in camping—on a 10-speed bike

By A. J. HAND

Own a 10-speed bike? Let it take you camping this summer. Rolling silently along the back roads it will introduce you to an America lost to the mile-a-minute Interstate armies. It will bring to life, with sounds, sights, and smells, scenes that are no more than a subliminal flash to the traveler sealed inside his car.

Too much work, you say, pedalling all that heavy equipment around. Not true! Thanks to the remarkable designs of today's backpacking equipment, a complete camping outfit—from tent to sleeping bag to stove and food and more—weighs less than just the tent of a few years ago. If you can't come up with a short-trip outfit totaling less than 35 pounds, you're just overpacking.

Okay. What do you need for bike camping? What will it cost? Where can you get it? Come on along and find out.

Briefly, let's discuss bikes. If you don't own a 10-speed lightweight, bike camping *can* be work. Of course you're not out to set speed records when you're camping. Speed will just make you miss most of the nature you're out to enjoy. But on a heavy, inflexibly geared bike you'll have to work just to go slow, and you won't enjoy anything. My advice: Camp on a 10-speed. If you don't own one, see the July 1971 issue of PS for a 10-speed shopping guide.

Bike plans made? Let's move on to what you'll need to tote your gear.

Carrying the load. Now and then you'll see a bike camper on the road, his load in a pack on his back. This isn't the way to go. It's better to let the bike carry the weight—you concentrate on moving it along.

Your equipment should go in a pair of rear-mounted saddlebags. When picking these "panniers," you want something big, light, and easy to use. A good basic bag, heavy but sturdy,

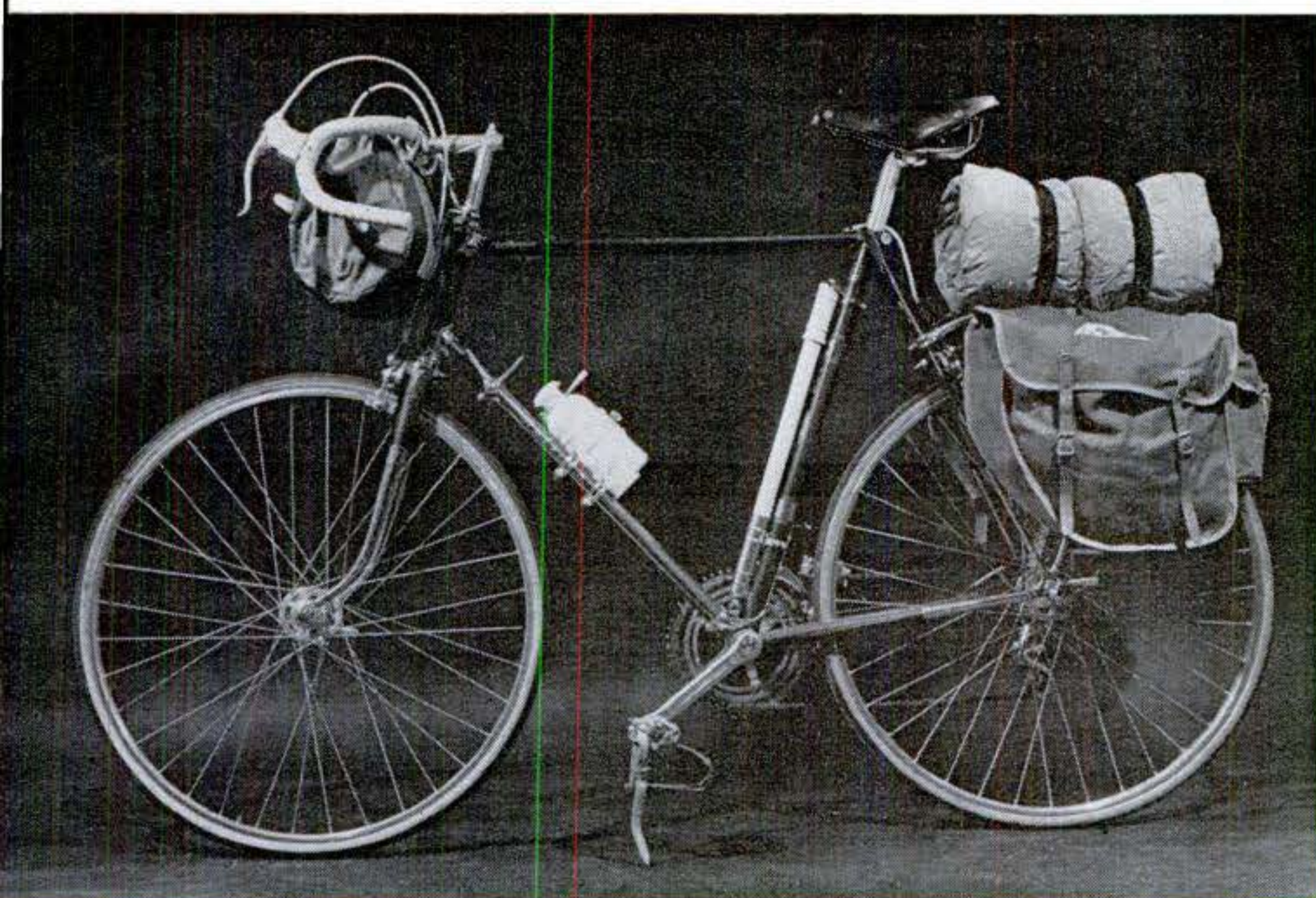
is the canvas design shown on the bike at the top of page 97. You can get it from the American Youth Hostels (AYH)—see the suppliers list at bottom of page 97. They're cheap—about \$11.50 for the pair—and fairly easy to attach and detach from your bike.

You'll get more capacity in a lighter pannier if you pick Gerry's design. It's tough waterproof nylon, with plastic stiffeners, and zippered compartments that distribute the load. They're about \$30 a pair from Colorado Outdoor Sports, Bean's, and elsewhere.

For the same \$30 you can get a lightweight nylon pannier from Bellweather (see source list) that's easier to attach and remove. These bags are new, and you may soon be able to get them from Schwinn dealers.

Another good alternative—especially if you plan to leave your bike parked at some point and take off on foot—is the TC pannier. It zips apart, and comes with a strap for backpacking. Source? Touring Cyclist Shop, Box 378, Boulder, Colo. 80302. Price is \$46.50 a pair.

For traveling light, panniers may



properly-loaded bike can take you on over-
night trips, weekenders, or cross-country
tours. Learn the ropes on short trips, then
reach out as experience grows.

bicycle tools and equipment checklist

Mafac tool kit
Small adjustable wrench
Small pair of pliers
Phillips screwdriver
Flat screwdriver

Tire-repair kit
Tire irons (clinchers)—2
Spare tire or tube
Extra spokes—6
Extra brake blocks—2

Rear brake cable
Gear cable
Chain rivet tool
Bicycle lock
Tire pump and gauge

camping equipment checklist

Lightweight
backpacking tent
Lightweight sleeping bag
Backpacking mattress
Stove w/fuel, nesting pots
Freeze-dried food

Mess kit w/knife,
fork, spoon
Scouring pads w/soap
Dish towel
First-aid kit
Insect repellent

Folding plastic water jug
Sewing kit
Nylon cord—50 ft.
Lightweight flashlight
Swiss Army knife
Matches w/waterproof case

Your first step in selecting a tent is to pick up a few camping catalogs to study what's available. Then decide how far you want to go in your efforts to cut weight. You can go pretty far out, too, if you want to spend the money. To see just how far, get information on Warmlite tents from Stephen's (23206 Hatteras, Woodland Hills, Calif. 91364).

Probably the best buy in a basic two-man backpacking tent is the Eureka Mt. Marcy. Like the best, it's made of ultralight ripstop nylon. It has a sewn-in floor of coated nylon, gives you adequate five-by-eight-foot floor space, and 3½ feet of head room—enough to let you sit comfortably.

I got mine—it's the one at the top of page 96—from Bean's for about \$40. They sell it under the trade name Two-Man Back Packer. Its weight—four pounds, 13 ounces—is pretty low for a two-man tent. The nylon is water-resistant, but it *will* leak in prolonged heavy rain, especially if there's a good wind. If you expect to encounter heavy rains, order the fly (a waterproof rain sheet that goes over the tent).

A one-man tent will save weight if you travel alone. Gerry's Pioneer tent, for example weighs just one pound, nine ounces. But if you're traveling with others, two- or four-man tents are a better solution. And even a four-man tent can be impressively light. Moor & Mountain (Concord, Mass. 01742) sells a double-wall design called the Thermo Expedition that tips the scales at only 5½ pounds.

Sleeping bags. You're still trying to save weight and, with sleeping bags, the best way to do it is to look for nylon shells with down insulation. Down gives you the most warmth for the least weight, and it packs to an incredibly small volume for traveling. Goose down is best, but duck down—about 85 percent as efficient—is a better buy.

Mummy or rectangle? Mummy bags are the most efficient, but for summer camping you can afford to trade off efficiency for freedom. Most rectangular bags can be zipped together in pairs for the camper's equivalent of the double bed. This is more

[\[Continued on page 152\]](#)

handle all your equipment. If not, you'll need a handlebar bag—or, God forbid, a pair of front panniers. You can get these items wherever you get the panniers for the rear.

Now you need something to fasten your bags to: a rear carrier. This is easy. Get an alloy type—no steel—for strength and lightness. You'll do best with the Swiss-made Pletscher. AYH and most good cycle outlets sell it for about \$3. Leave it on your bike when you aren't camping. It's good for carrying small packages, books etc., and it will encourage you to use your bike more often.

Now if you've overloaded your bike and you're forced to use more than a

handlebar bag in front, you're also in the market for a front carrier. Bad news: There's only one good front carrier at present, and it fits only bikes with Mafac brakes. Trim your load, or buy Mafac brakes and the T.A. carrier from Cyclopedia.

Now we can move on to something more interesting—camping gear.

Picking a tent. Although some backpackers and bike campers dispense with tents, today's designs are so light and compact it makes little sense to risk a trip without one. Even if the weather is warm and dry, a tent is still useful for sealing out insects. And it may give you a feeling of security you'd miss sleeping in the open air.

Equipment sources and what they sell

Eastern Mountain Sports
1041 Commonwealth Ave.
Boston, Mass. 02215
(Camping equipment)

Colorado Outdoor Sports
P.O. Box 5544
Denver, Colo. 80217
(Camping equipment)

American Youth Hostels
535 West End Ave.
New York, N.Y. 10024
(Bike and camping)

Cyclopedia
311 N. Mitchell
Cadillac, Mich. 49601
(Bikes, tools, panniers)

Ski Hut
1615 University Ave.
Berkeley, Calif. 94703
(Camping equipment)

L. L. Bean, Inc.
Freeport, Me. 04032
(Camping equipment,
panniers and bags)

Bellweather
1161 Mission St.
San Francisco, Calif. 94103
(Panniers, bags)

Big Wheel Ltd
310 Holly St.
Denver, Colo. 80220
(Bikes, tools, panniers)



Beginning here: 27 pages of home-improvement ideas

By AL LEES
Group Editor, Reader Activities

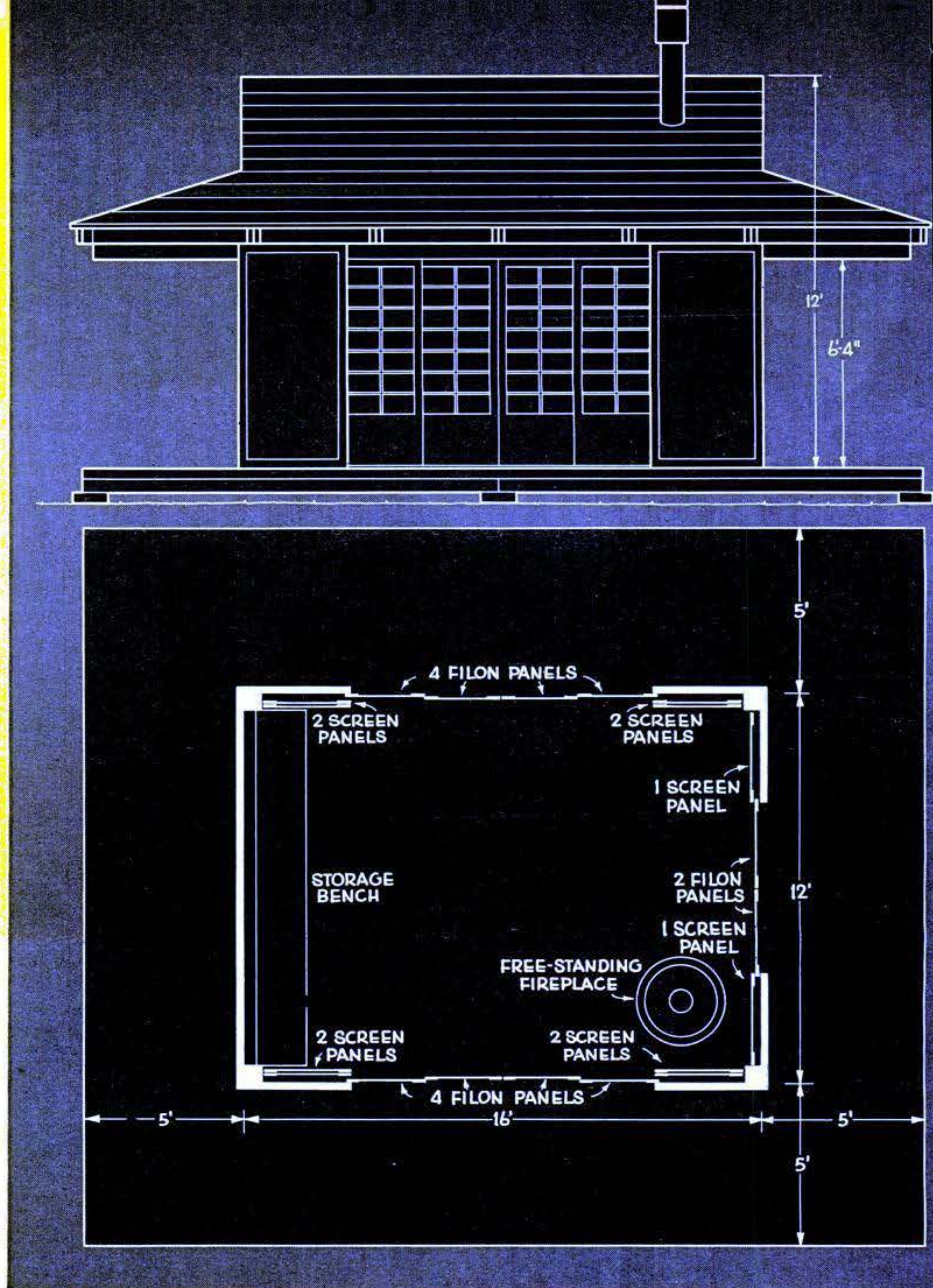
Nice to feel the sun again, isn't it? Any week now, homeowners will make that annual shift in orientation—from indoors to out—that this special section is designed to implement.

Early last summer we asked our top contributors to create projects to add zest to leisure living. To start the section off, we commissioned the architectural drawing firm of Sigman-Ward to prepare plans for the backyard teahouse shown on these pages. And as an ideal approach to such a structure, what could be more fitting than the arching Japanese bridge on the following spread?

With summer's stepped-up outdoor activity, you'll be looking at the exterior of your house more critically. This is the season to tackle improvements that require opening a wall to weather—such as adding a bay window. Scattered further along in the section are a half-dozen projects to perk up patio living, together with tips on appliances, tools, and techniques to keep your summer carefree.

Our long-term planning didn't stop with this issue—especially since our long-awaited centennial issue follows posthaste. We've been engaged in a year's frenzy of home building on scattered fronts, and two major shelter projects will be introduced next month. POPULAR SCIENCE isn't content to fill its pages with "pickup" houses from other sources; we prefer to design and build our own, so that we can present the plans with a confidence you can share.

And I'm just back from scouting the National Home Builders annual expo in Houston's Astrodome, where thousands of new products for the home are introduced each year. Stick with us—we've planned you quite a summer.



Outdoor Family

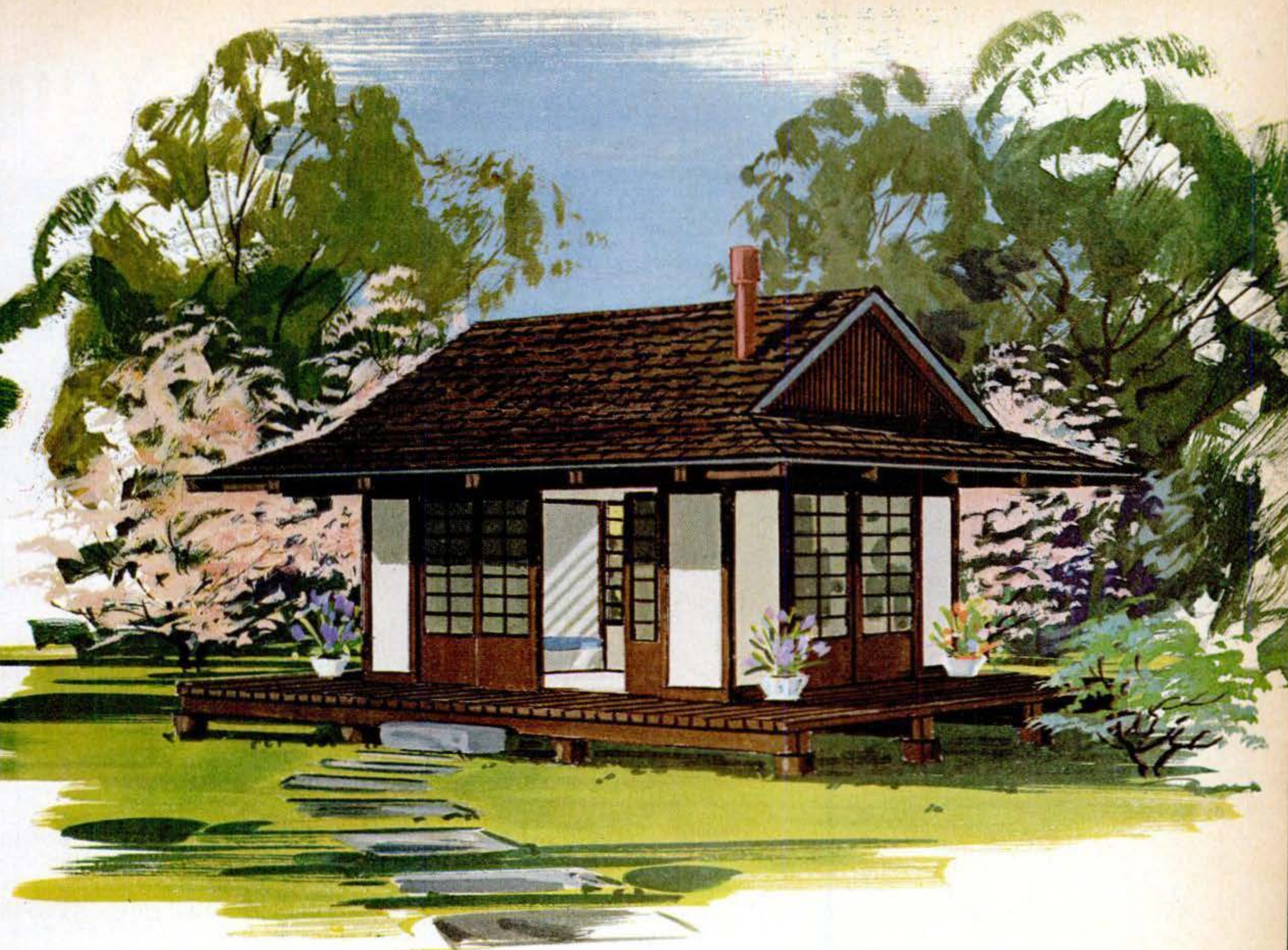
One of the most gracious structures ever devised is the small garden house built near fine Japanese homes as a setting for the traditional tea ceremony. The surprising thing is how well an adaptation of the teahouse meets contemporary needs for backyard activities.

The versatility of the teahouse lies in its convertible walls. Ours has 10 pairs of sliding doors (designed to resemble authentic shoji screens) that store behind the corner plywood panels. Half of these doors frame sheets of translucent plastic (a practical substitute for Japanese rice paper); the other five pairs are covered with fiberglass screening.

On a balmy afternoon, you leave

all 20 doors pushed back, and use the house as an open gazebo. If insects arrive with the twilight, you slide the screened panels shut to create a breezeway. Should a sudden squall come up—or if you wish to add privacy for an evening party—you push back the screened doors and draw the solid ones instead.

In our version, one short wall is solid, with a built-in bench that sports a padded seat, sections of which are hinged for access to the ample storage space below. You'd set this blind wall close to the property line; if the structure is to occupy a corner of your lot, you might make one long wall solid as well, creating an L-shaped privacy screen. Hang shelving on standard



Take a tip from Nippon: This easy-to-build structure has 20 self-storing doors that change its personality—and use

Room in Japanese Style

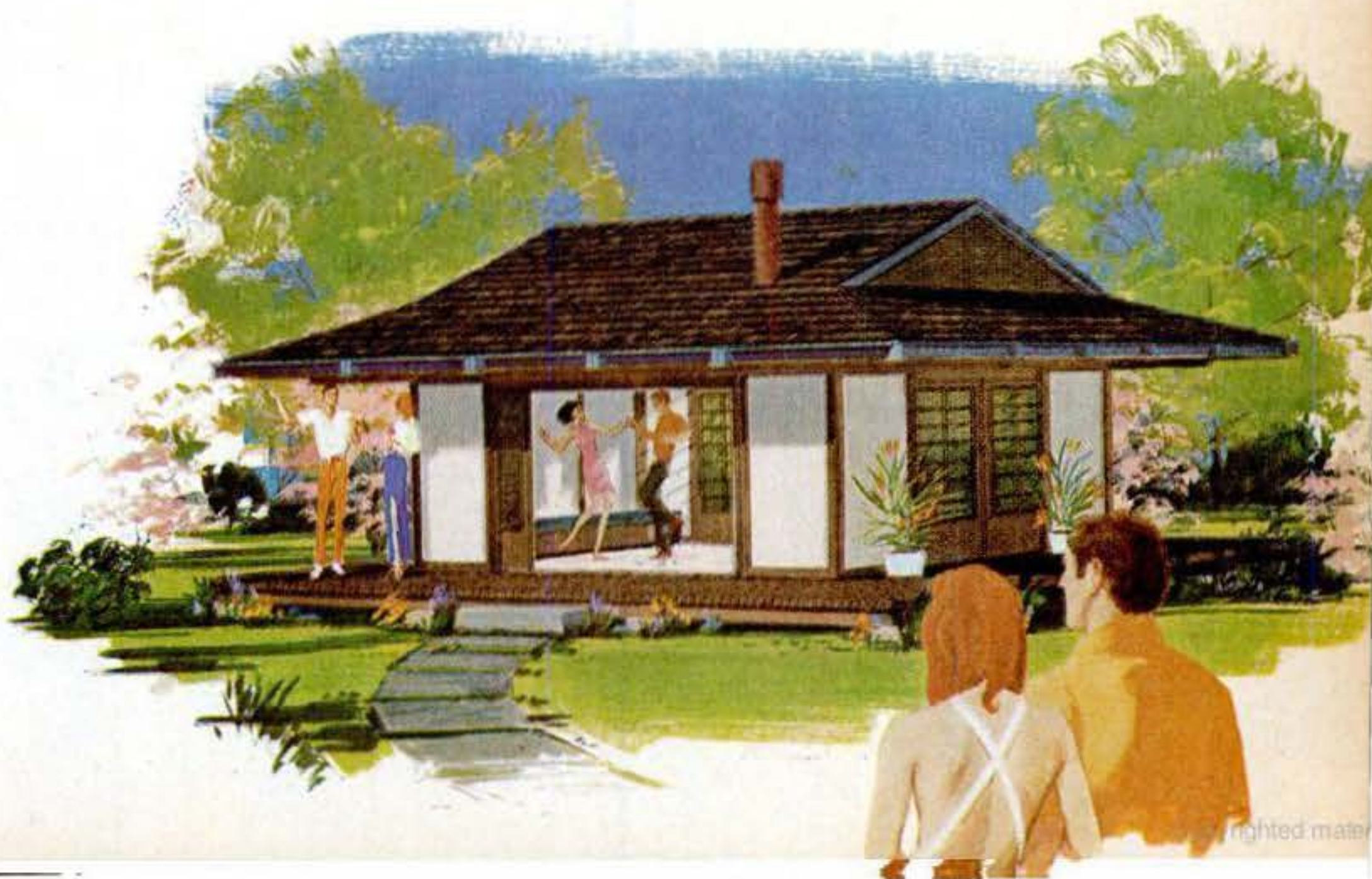
and brackets for open storage of bar equipment and hi-fi components.

The roof's extreme projection gives you a sheltered deck in all weathers. Tuck a free-standing fireplace in one corner and you'll extend use of your backyard family room well into autumn. Close and padlock the solid doors next winter to create storage for out-of-season items such as lawn furniture and barbecue carts.

For construction sketches and information on ordering architect's plans (you may need them to file for a building permit), turn to page 120.

Enlarged floor plan for big parties? Framing is sturdy enough for wider spacing, but roof pitch may change.

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Build Your



Handsome year round, bridge adds distinction to author's yard. Foreground bench is bonus from leftover 4x4s (legs) and 2x6s.

Need a footbridge? Make it full size. Or scale it down to decorate your garden

By PHIL McCAFFERTY

You may not want to duplicate my Japanese-style bridge exactly, because the project needs to be tailored to your yard. Your version needn't even be a footbridge: Scaled down (as indicated at top-left of the facing page) it could span a fountain or waterfall runoff, or just supply a background for a flower bed.

Construction is simpler than you'd think. The uprights are 4-by-4s set in concrete footings. The arched rails are laminated from 1-by-4s which—individually—are easy to bend.

My bridge is "construction heart" redwood, which needn't be treated or finished to perform well in contact with the ground or exposed to stand-

ing water. In a year or so, the wood will take on that characteristic purple-gray patina, and only the turned finials will ever need repainting.

The bridge could, of course, be built of any sound softwood recommended for exterior construction—if you give it a preservative treatment before painting (mandarin red and black, or a light green, say).

Figure your size. The 40"-wide bridge shown is 20' long. The radius of the floor arch is 28'—the longest length and smallest radius that you should attempt. Steeper humps cause walking and bending problems.

For a bridge half this length, you'd halve the radius to keep the same arc. A greater radius would make a shallower hump.

Whether you scale down slightly, for a shorter span, or severely, for a decorative miniature, you'll want to make a layout on wrapping paper—scaled ($\frac{1}{4}" = 1'$) for a footbridge, or full size for a miniature. You'll be able to take cutting angles right from this layout.

Erecting your bridge. Scribe the ground line on all eight posts. Then, in one direction from the line, mark a length to reach below frost line; in the other, mark the post height above ground and the locations for support blocks and handrail.

Tops of the end posts are square, with holes for finial dowels, but center-post tops are "crowned" to conform to the handrail curve. Take the angle off your layout with an adjustable protractor and transfer it to the post for cutting with a sabre or band saw. Support blocks are also matched to the arc of their rails.

To check curve accuracy of the first rail strip (for adjusting temporary supports) use this formula of the circular segment height:

$$H = R - \sqrt{R^2 - \frac{\text{Straight length}^2}{4}}$$

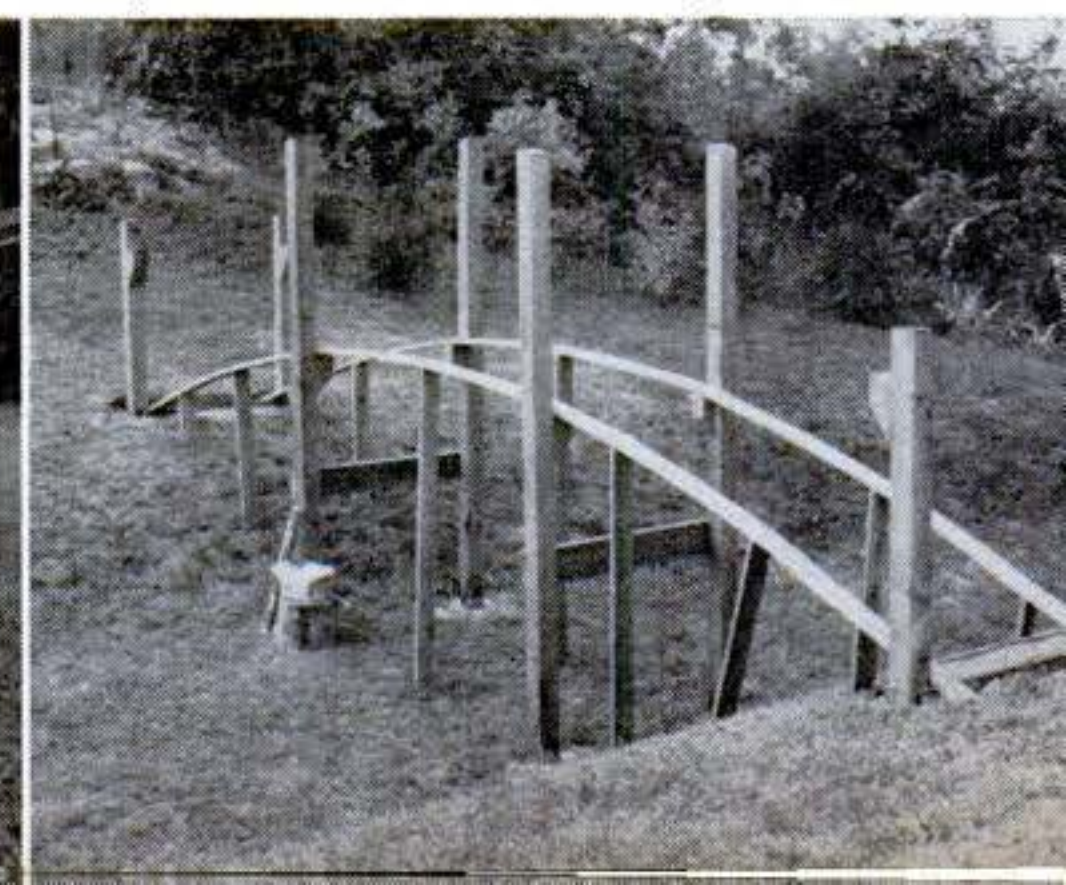
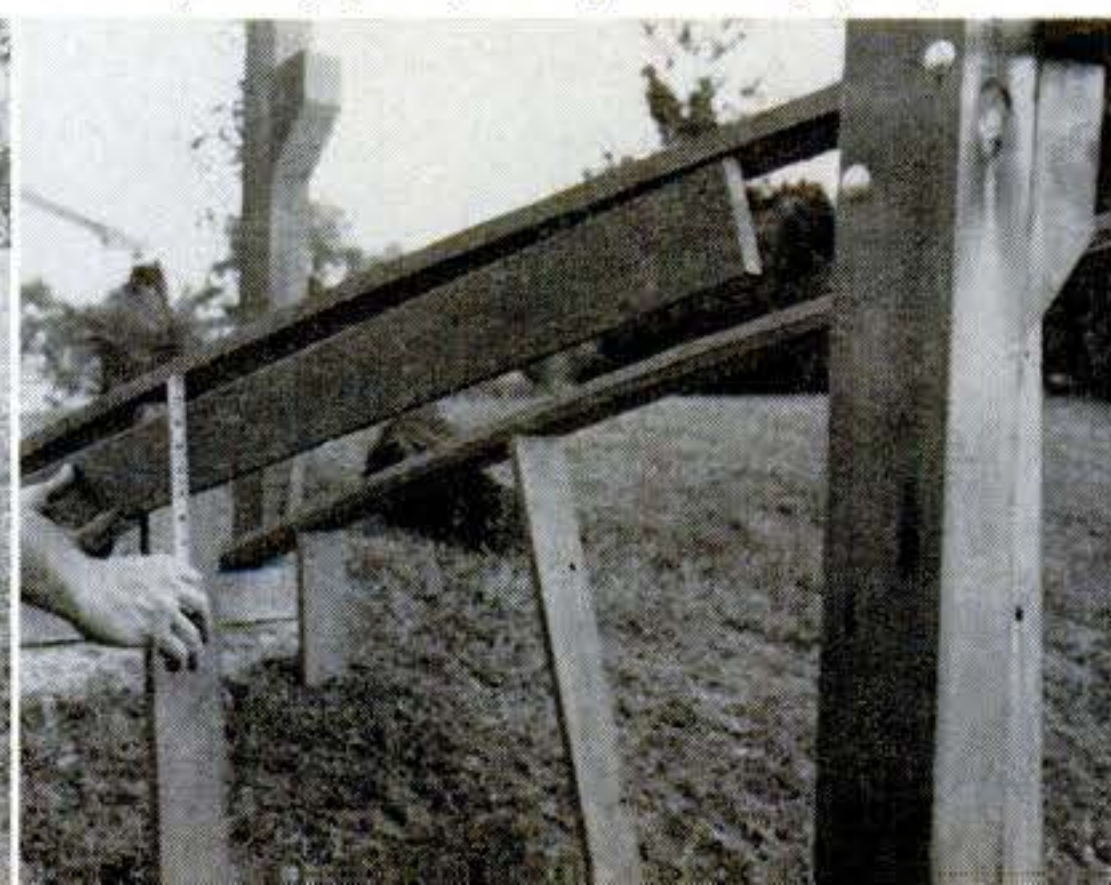
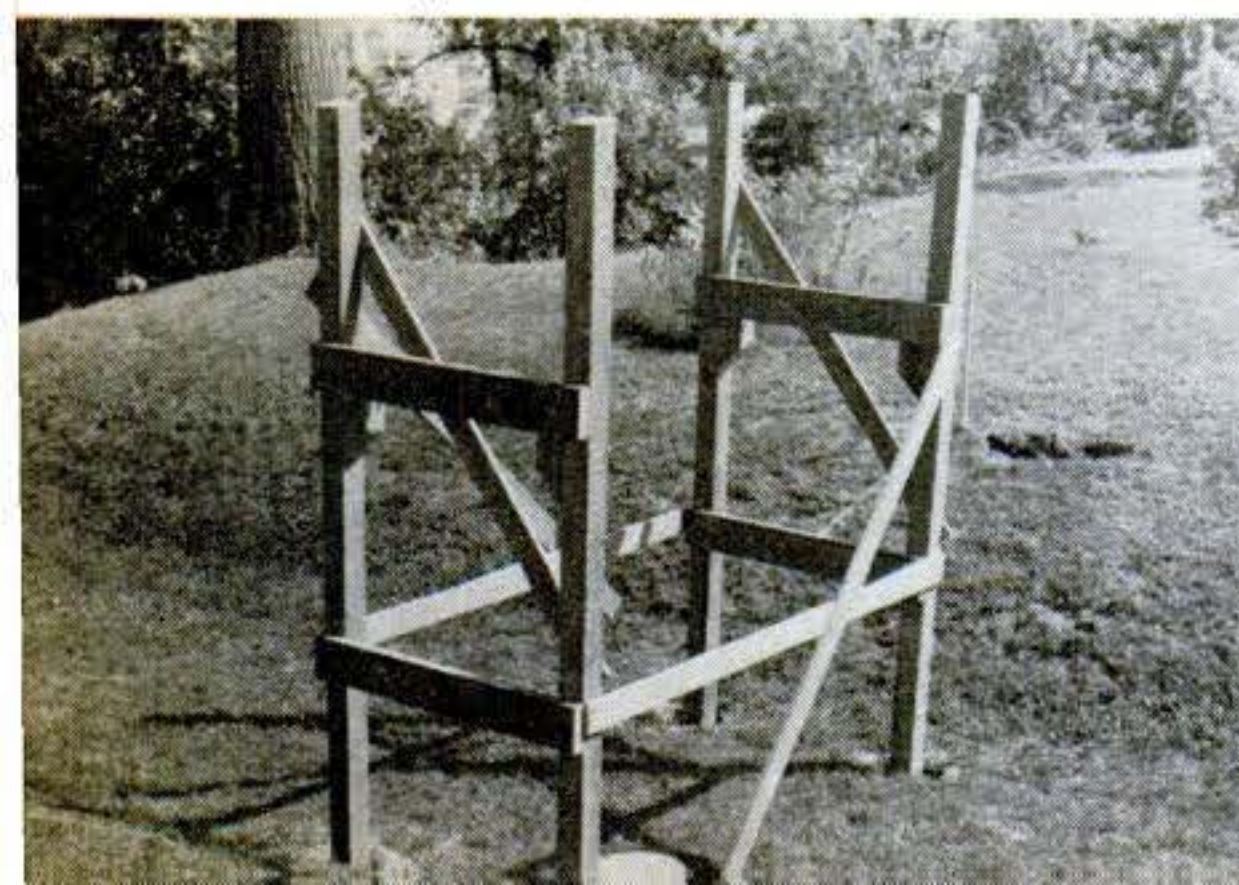
E.g.: height of about $1\frac{1}{16}"$ for a 28' radius and a 5' straight edge.

Side-rail lengths may require some cut-and-try. Select sound, knot-free wood for support members. Use waterproof glue and galvanized nails. **PS**

Four center posts are preassembled, lowered in holes, plumbed and leveled. Concrete is poured, cross braces removed later.

First strip of floor rail is arched into place against temporary props. Check arc with straightedge, adjust by moving prop.

Leave props in place until added laminations fix shape. If joints are needed on first rails, make them at center-post locations.

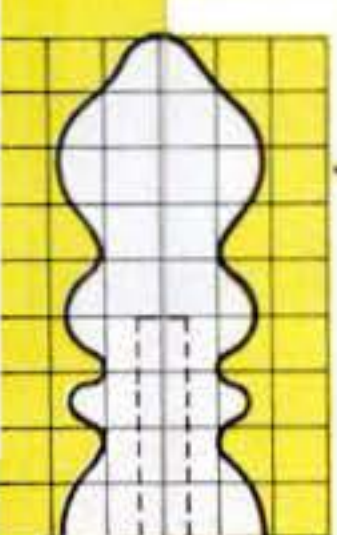
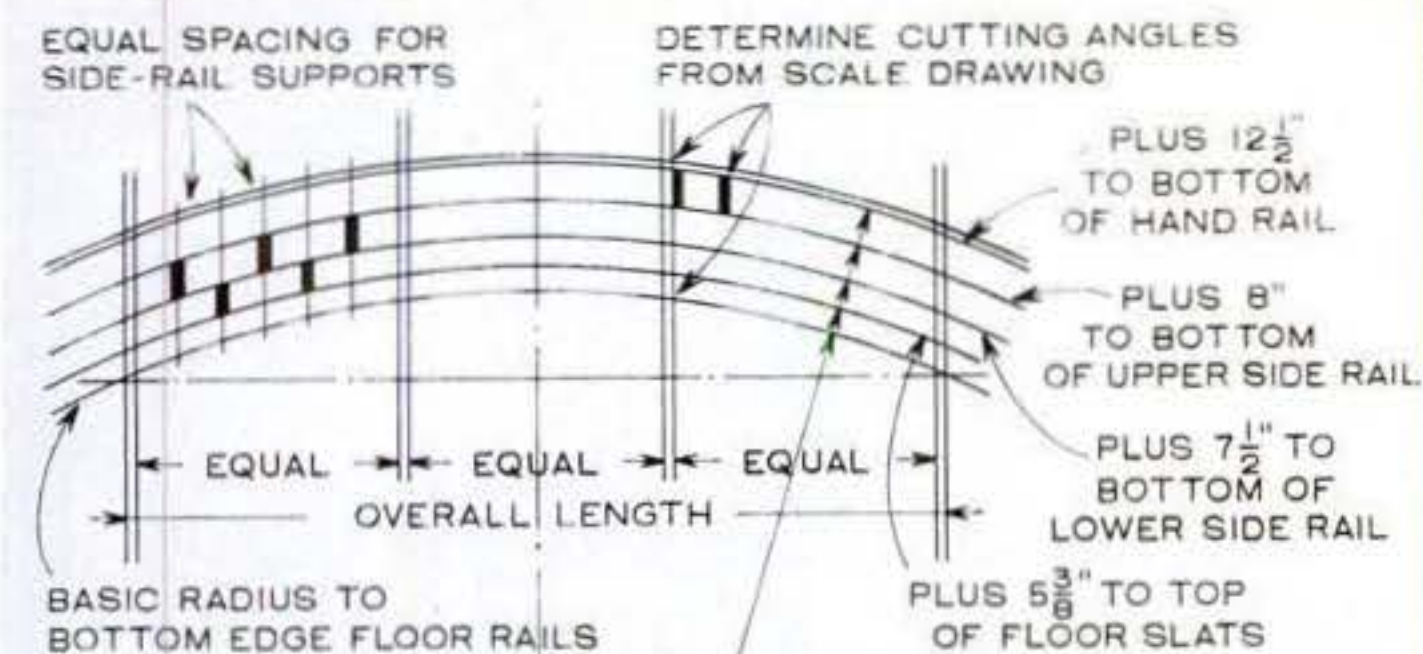


Own Japanese Bridge



IMPROVE YOUR HOME

HOW TO MAKE QUARTER-SCALE LAYOUT



DETAIL (1" SQ'S.)
OF 9" FINIAL FROM
POST STOCK

1" DOWEL
HOLE

FLOOR
RAIL

POST

CONCRETE
GROUND

TAPERED LAMINATIONS
1 x 4 x 36" LONG
ADDED AFTER
FLOOR RAILS
ARE COMPLETED

CENTER
LINE

NOTCH
SLATS TO FIT
AROUND
POSTS

GROUND LINE SCRIBED ON POSTS

TYPICAL
GROUND
LEVEL

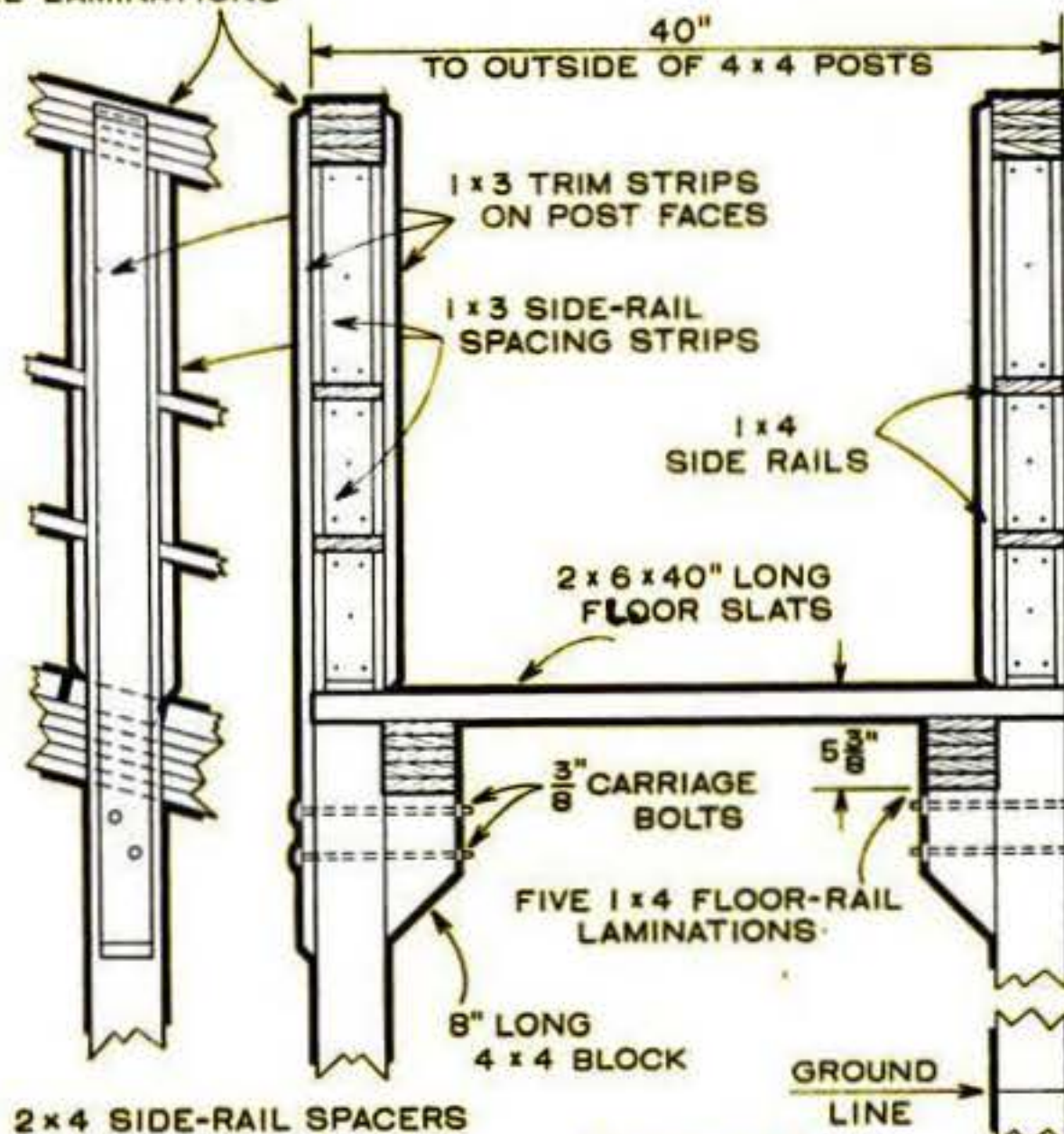
1 x 4 x 40"
CONCRETE
GROUND

12" x 48" FOOTING
TO BELOW FROST LINE

FOOTING

SECT. "Z"

FOUR 1 x 4's HAND-RAIL LAMINATIONS



VIEW "X"

FINIAL
SEE DETAIL AT LEFT

DIMENSIONS
FROM
SCALE DRAWING

VIEW "Y"

COUNTERBORE FOR
3/8" x 6" LAG BOLT

FOOTING END

RAIL-SPACING
STRIPS

2 x 6 x 40"
FLOOR SLATS
SPACED 3/4" APART

GROUND
LINE

1 x 4 x 40"
CONCRETE
GROUND

FOOTING

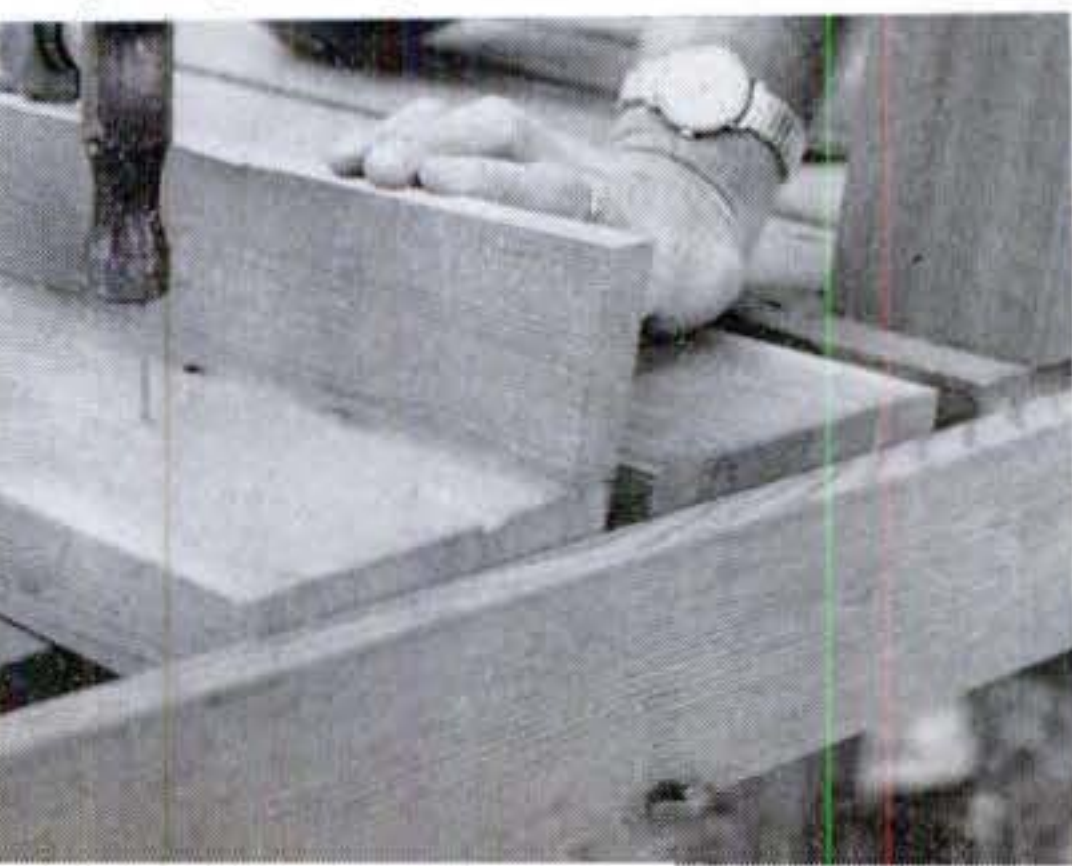
SECT. "Z"

NOTE
GLUE ALL JOINTS WITH WATERPROOF GLUE.
USE GALVANIZED NAILS AND PLATED OR GALVANIZED BOLTS.

Nail floor slats to rails with temporary guide strips to align edges, 3/4" scrap for spacing. Use galvanized or aluminum nails.

Laminate handrail similarly, maintaining arch with props to the floor. After waterproof glue sets, round and sand edges.

Glue and clamp tapered strip to ends of floor rails, butted against crosspiece. Non-slip paint on floor finishes the job.





Bay, Bow, or Box— windows that add elbow room

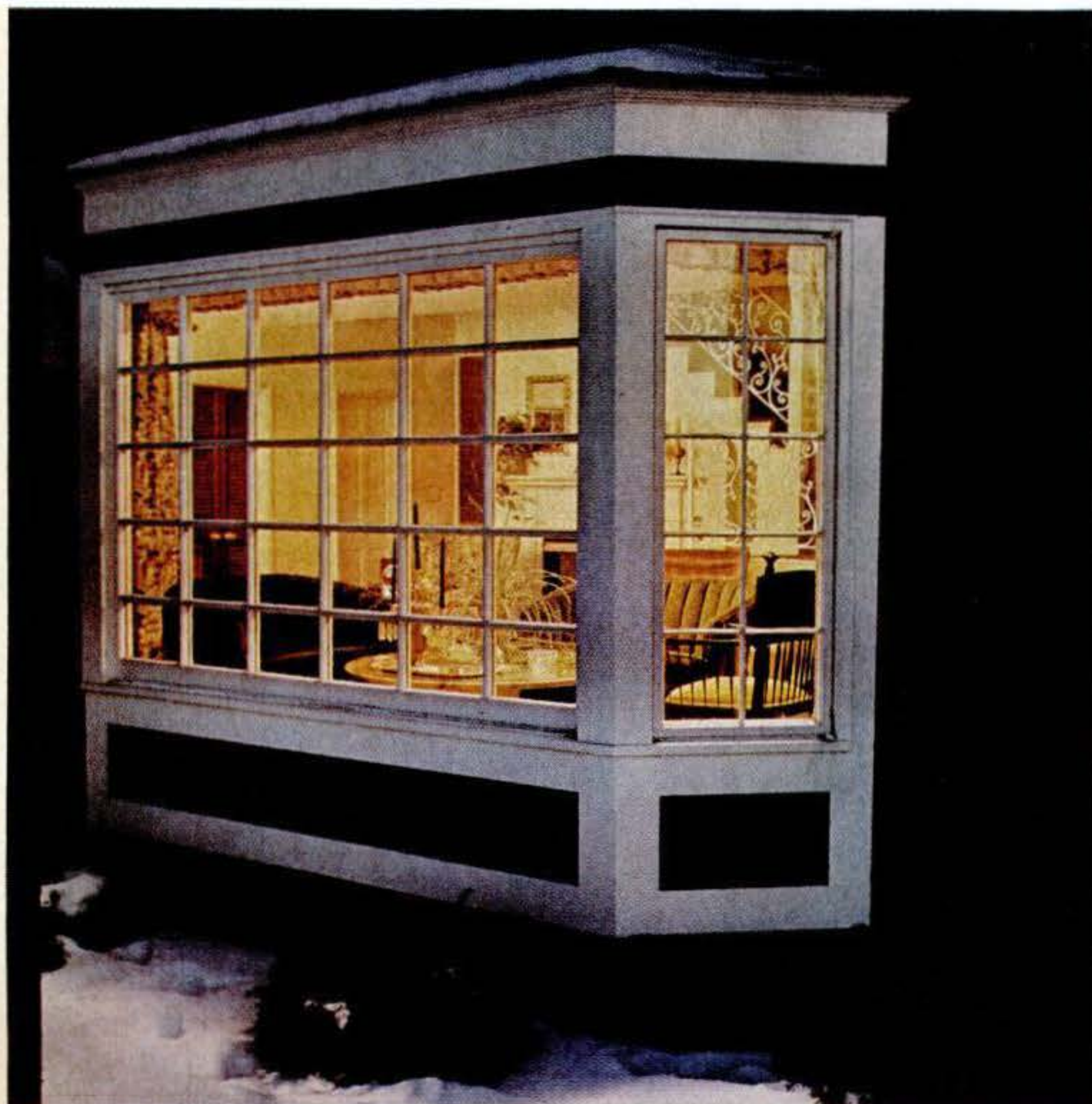
Does at least one room in your home always seem cramped? It's surprising what a sense of space you can get by replacing one window with a unit that widens the room's horizons by pushing back that single wall.

Such window units fall into three main categories: angle bay, bow, or box—but there's great variety within

each classification. The sash can be regular double-hung, casement, awning, or fixed; the height can match that of the window you're replacing, or can extend downward so that you actually increase your floor space. Either way, the extra room can be put to use for seating, shelving, or special furniture arrangements.—*Al Lees*



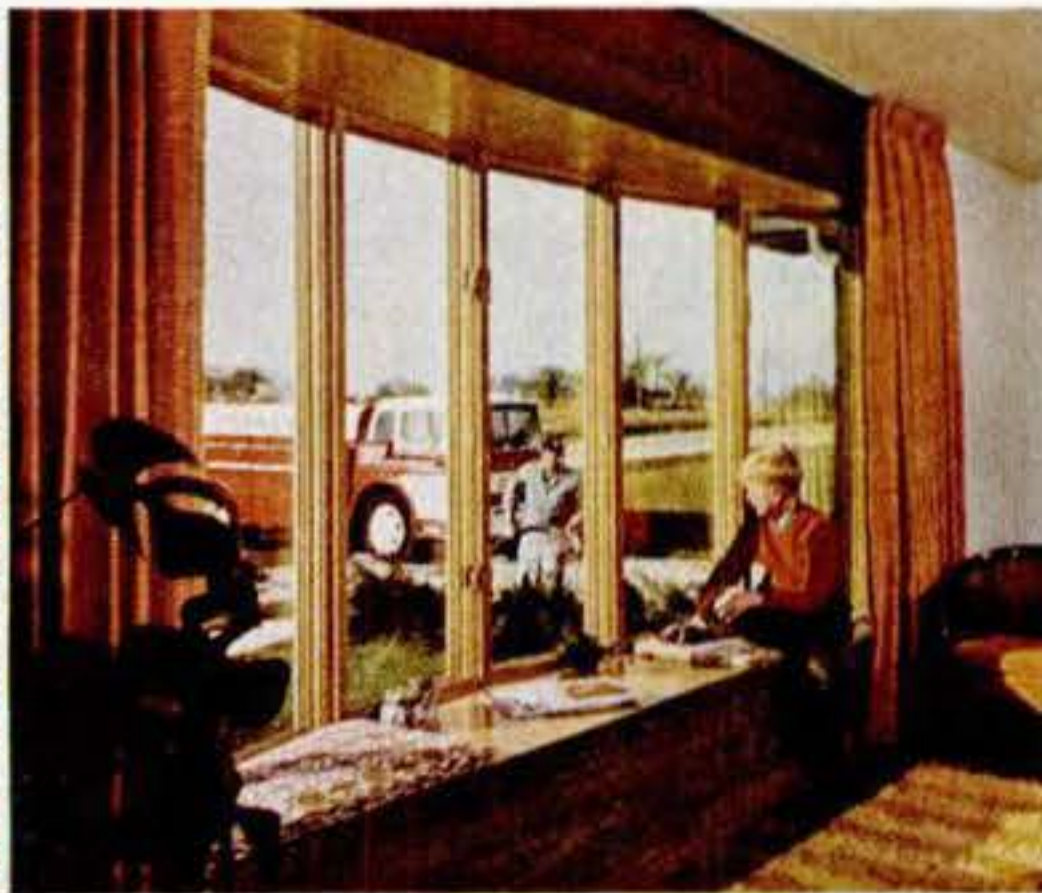
BAY Both exterior views show angle bays with casements flanking a fixed center sash, but roof treatments differ, and unit at left has solid panels at base with window-seat storage inside. Bay below is created from three double-hung wood windows, added to create a bright breakfast area in dark-paneled kitchen.



BOX Typical installation is the heavily framed window, far left (casements flanking fixed center) with soffit providing closure at top, and sides boxed in. But box at near left was created with double-hung windows set square at sides (not angled, as in bays above). Delicate muntins may be actual or achieved with grille inserts snapped inside large single panes. Usually available from window manufacturer, grilles are removable for easy cleaning of large pane.



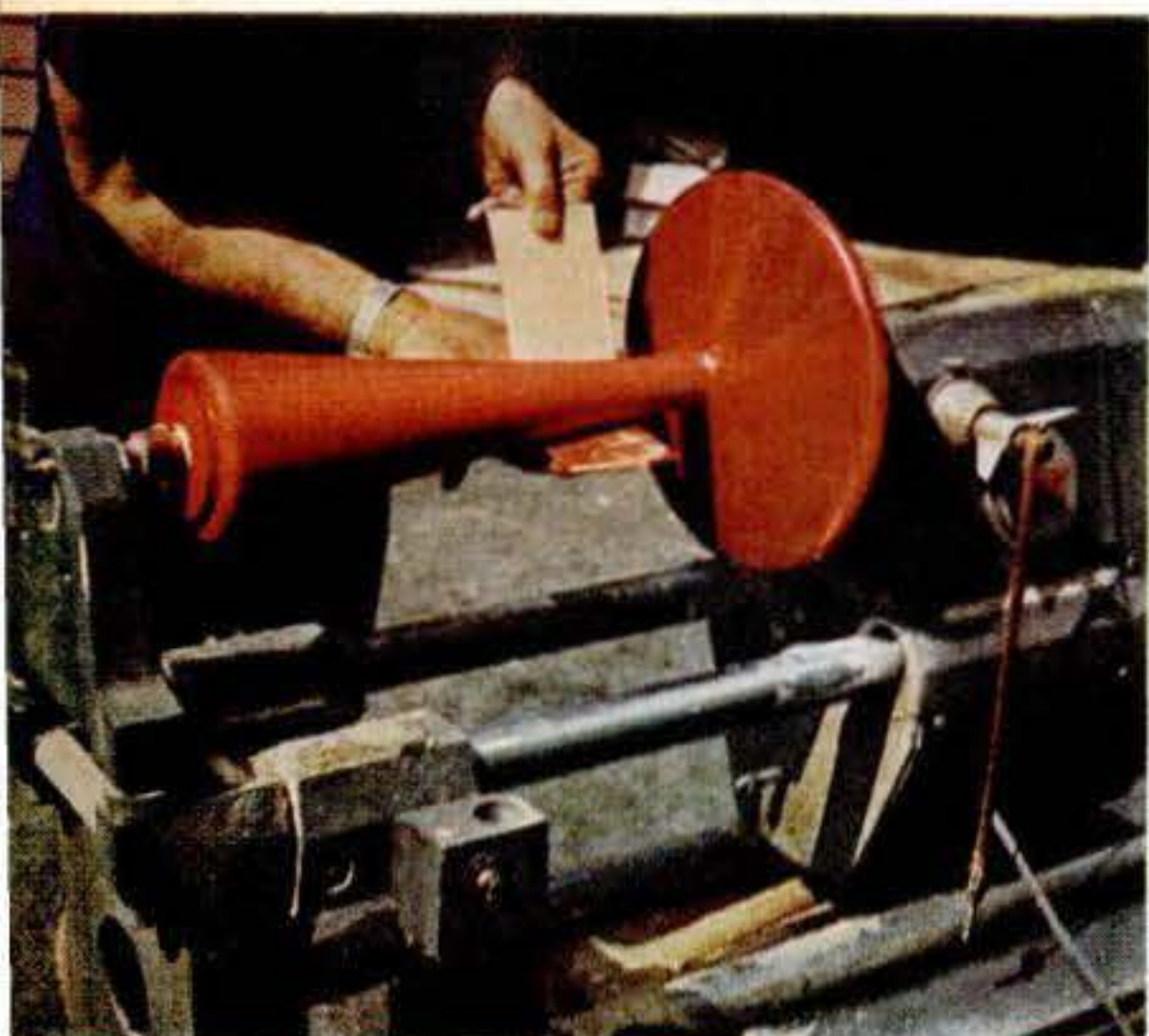
BOW As name implies, these are gracefully curved extensions that can be added to houses of any architectural style. If eaves already overhang, as at right, no special roof is required. Working sash—for ventilation—can be side casements (photos above and below) or upper awning sash (right and bottom right). Casement bows come in three to seven units, awning bows in various fixed/working combinations. Some units are factory assembled, with head and seat boards and extension return jambs installed, screens included for working sash. Boards and screens are optional with other units—check to make sure they're available. Interiors below show how height of unit helps determine use of added space: at chair-back height, sill creates useful shelf (left) or in dining areas can serve as sideboard. Lower sill (center) forms ideal windowseat. Floor-length windows (right) actually increase room size, permit new furniture groupings. Floor bow can make room for baby grand, for example.



For tips on selecting and installing these units, turn to page 122



For the Patio: KING-SIZE



Quickest way to a perfect finish is to spray or brush on a coat of enamel, then put the project—when it's dry—in the lathe for sanding. Slow lathe speed gives smoothest finish. Repeat process until sanded enamel is as fine as the best porcelain.

A lathe project with a fresh twist brings a glow to your outdoor living

A novel and attractive source of outdoor illumination is this outsize candlestick with a three-sided globe made of Plexiglas. Use it with an antbug candle and it wards off pests while it lights your patio. Come fall, move it indoors, where it's a striking accent piece.

You turn the base from a glued-up turning block. You can speed the operation by cutting the block to a rough circular shape at the bottom with a saber saw. Then work with regular lathe tools.

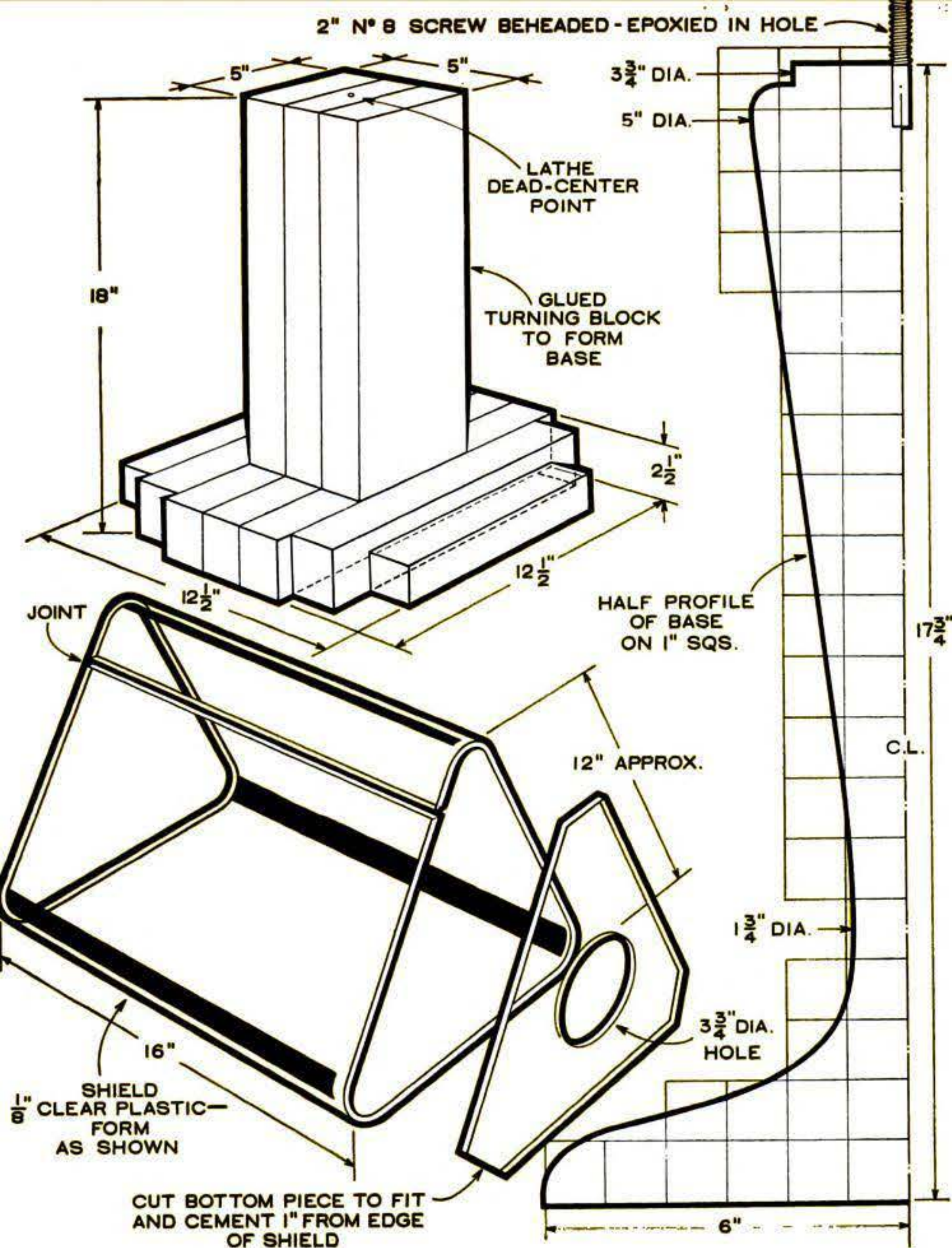
For the shade, you'll need a sheet of $\frac{1}{8}$ " clear Plexiglas. Cut a foot off one end, leaving yourself a piece 18

by 36. Plane, sand, and polish the edges of this piece, then bend into a triangular tube and solvent-cement the seam.

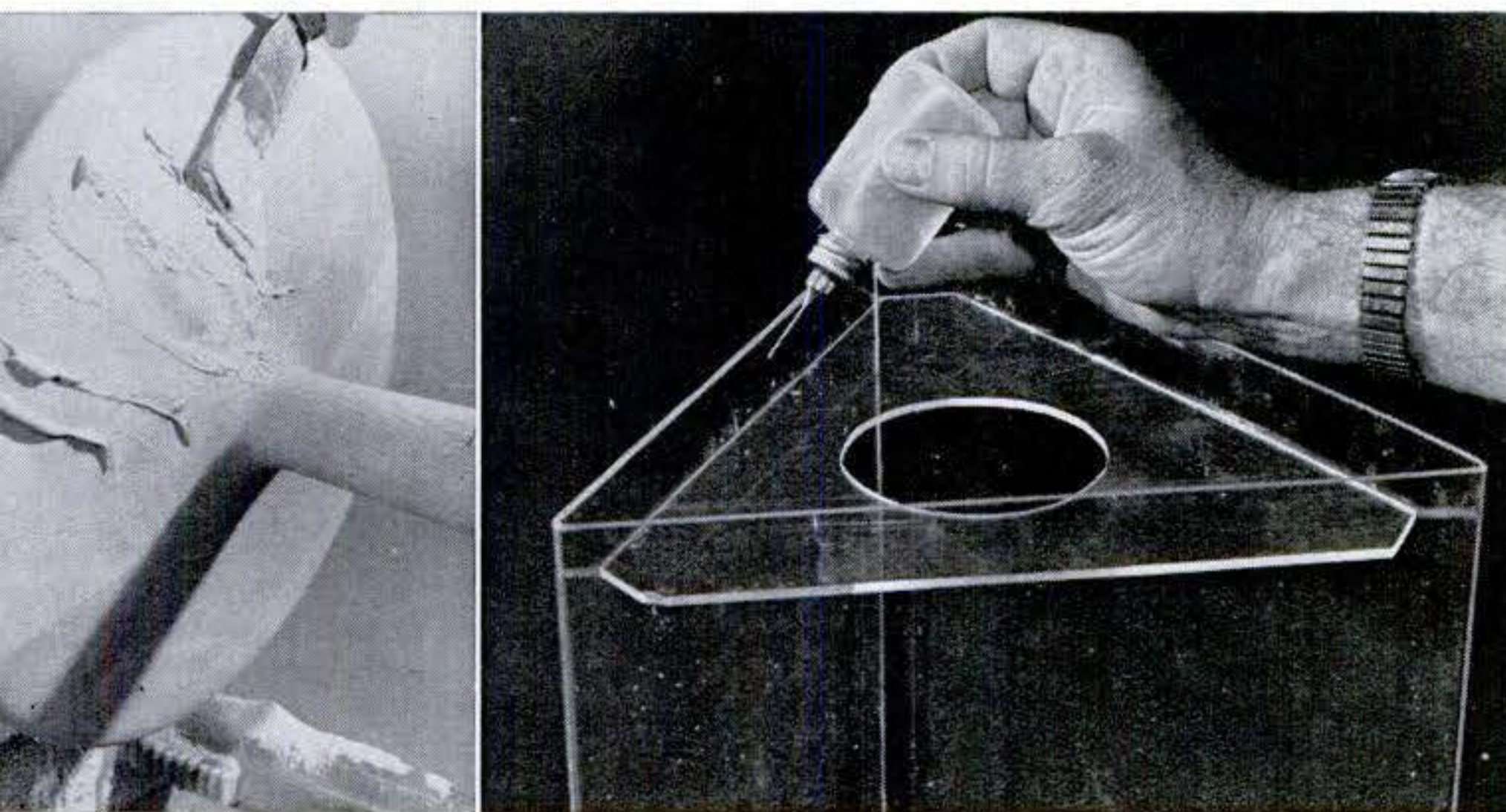
Trace the inside of the tube on the extra sheet of plastic. Cut it out a scratch oversize, then smooth to fit inside the tube. Locate, cut, and smooth the center hole, and finally glue the piece in place.

Shade and base finished? Mount a candle by twisting it down onto the screw at the top of the base. Slip the shade onto the base, and you're ready to light up.—*Jackson Hand*

Note: If you don't know where to get Plexiglas, or how to work with it, send a quarter to Rohm and Haas, Box 9730, Philadelphia 19140. They'll send you a list of distributors in your area and the booklet "Do It Yourself with Plexiglas Acrylic Sheet."



CANDLESTICK



Smooth end grain by filling it with a thin water-mix putty or vinyl patch. When it dries, sand to a glassy smoothness on the lathe with fine paper.

Triangle of Plexiglas with corners cut off (this allows air movement up through globe) fits inside shade. Chemical-weld it an inch up from the bottom. Chemical welding is one of the many Plexiglas working techniques outlined in the booklet described in the note at left. Also covered are cutting, sanding, polishing, and bending.

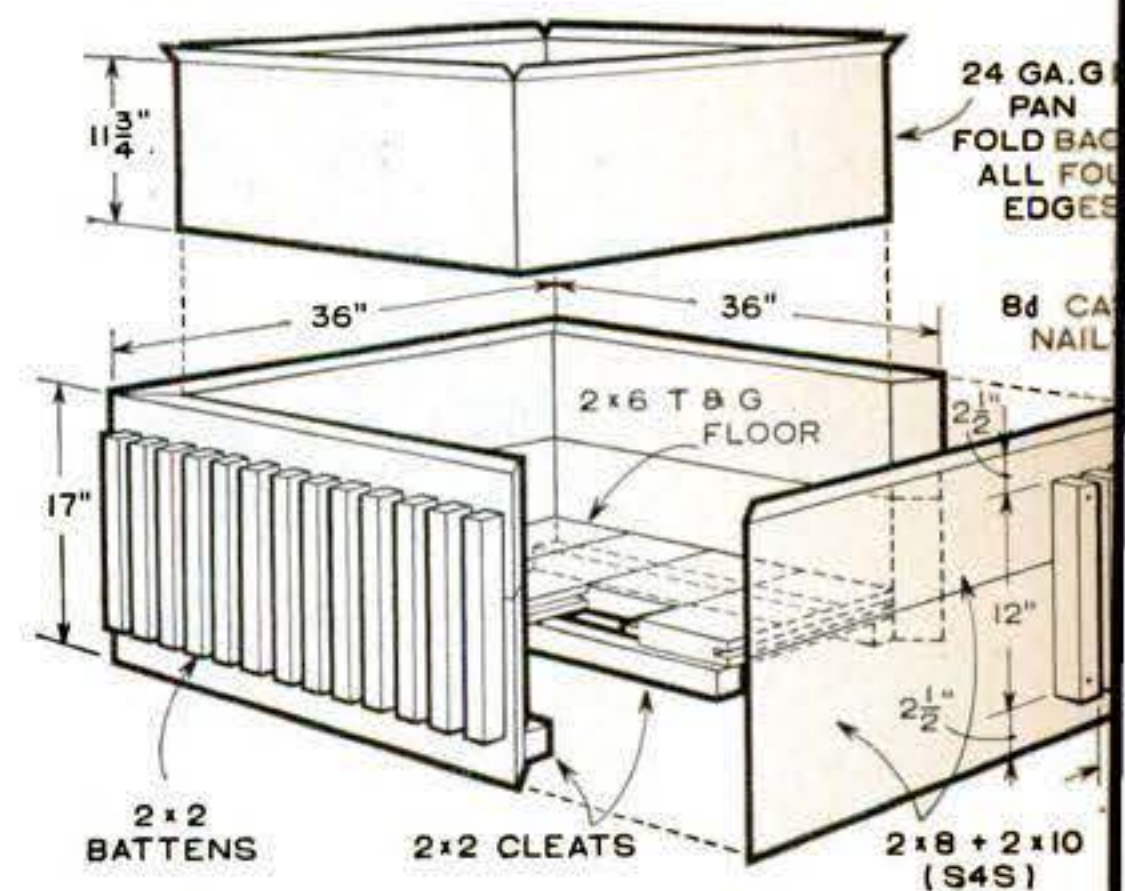


IMPROVE YOUR HOME



BATTEN PLANTER

Sometimes the simplest materials and techniques make the most appealing projects—as with this patio planter, designed for Western Wood Products Assn. You just nail it together from ordinary framing lumber—two-by-two, two-by-eight, and two-by-ten fir—and tongue-and-groove flooring. The metal liner is optional; two or three coats of a good epoxy paint will protect the wood and seal the seams just as efficiently.



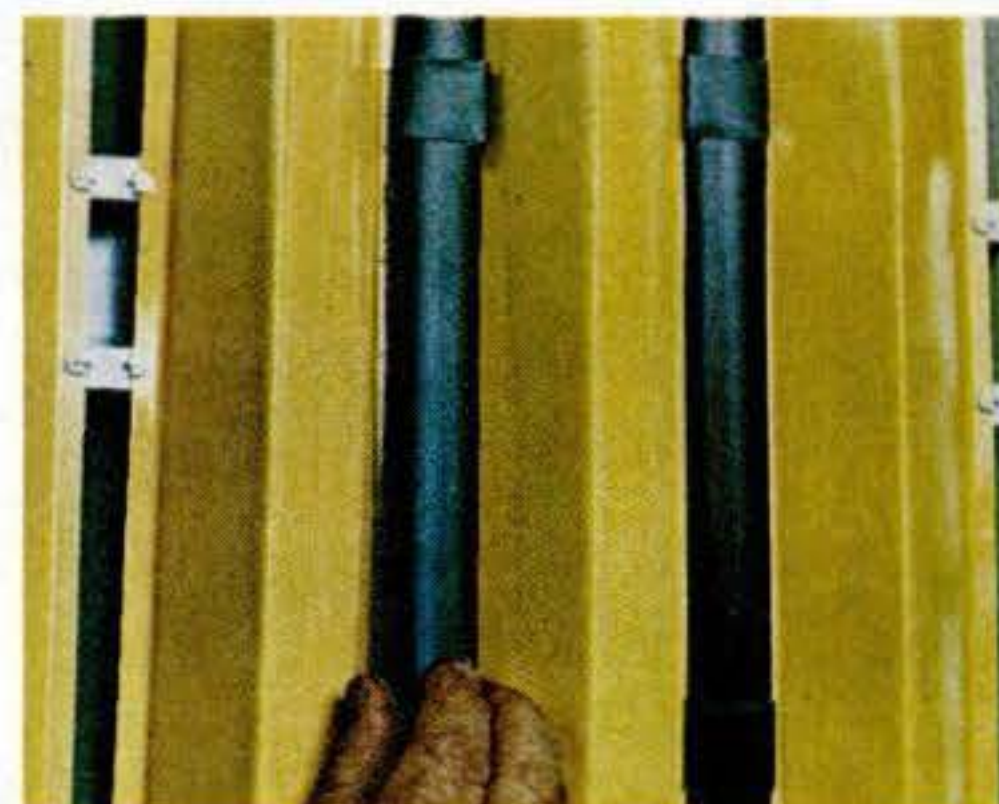


Vanes are so light that your wife won't have any trouble helping you install them. Ten-

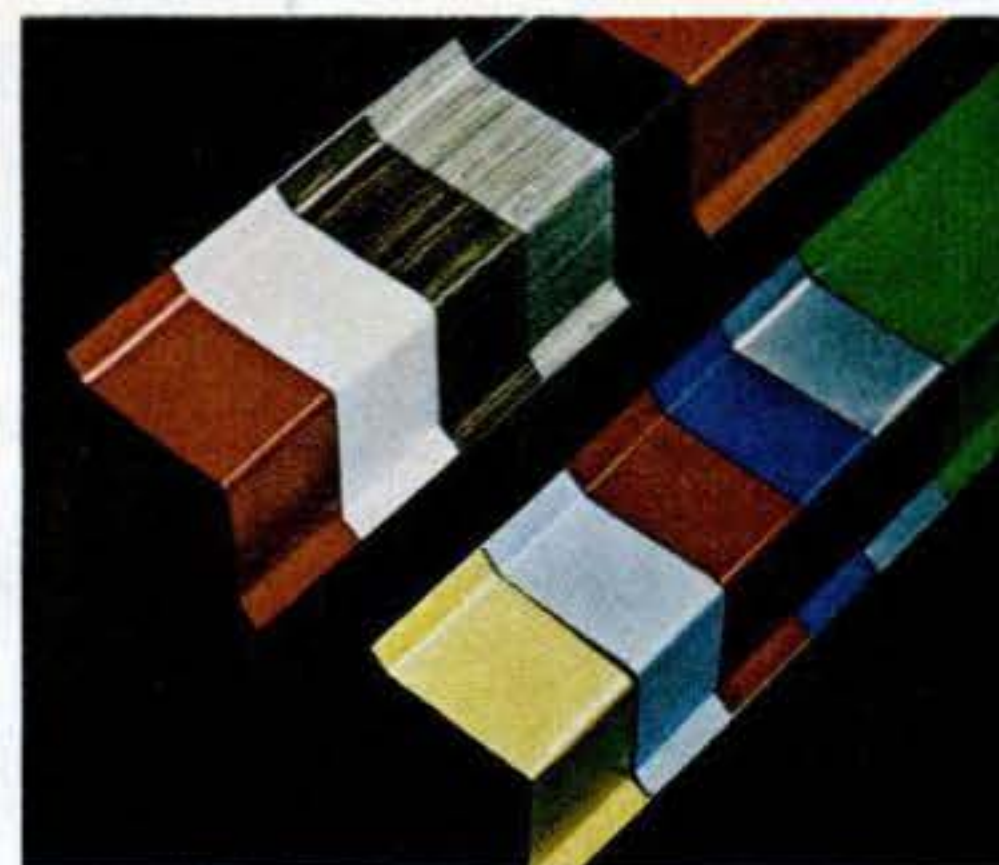
foot vanes weigh less than $\frac{3}{4}$ pound each, making their installation a breeze.



Resilient vanes snap into four catches (two on each side) on support runners.



Press in the clips (top) to install optional strips in between slats.



Twelve colors, shown here, will liven any room. Change your mind? Change the slat.



One tube, selected from 34 available, gives you your color. Then you keep mixing color into white paint until you get the desired intensity. No waste—you mix only what you need.





Brighten Your Home with Snap-in Color Slats

This novel aluminum paneling system adds zest to a room and can even reduce noise in a home

Mission: You want to jazz up the walls or ceiling of your basement or den. You're tired of the usual choices—wallpaper, paint, and wood-grain panels. Solution? Ecol-o-Vane, a unique new system of snap-in color paneling.

These matte-finished aluminum vanes are superlight but strong. The paneling (including the support runners attached to the wall) weighs only a little more than a half-pound per square foot. Yet the vanes have a tensile strength of 59,000 psi.

The V-shaped vanes make a room a lot quieter. When sound waves hit the paneling, they're broken up by the irregular surface. Part of the wave energy is dispersed in turbulence, and part is absorbed by the slats. The maker says that you get super quiet with an acoustical blanket installed behind the vanes.

There's optional stripping to fill gaps between slats. If the wall you are covering is reasonably attractive, you can let its contrasting color and

texture show through for an interesting effect. If not, snap in strips for a complete cover.

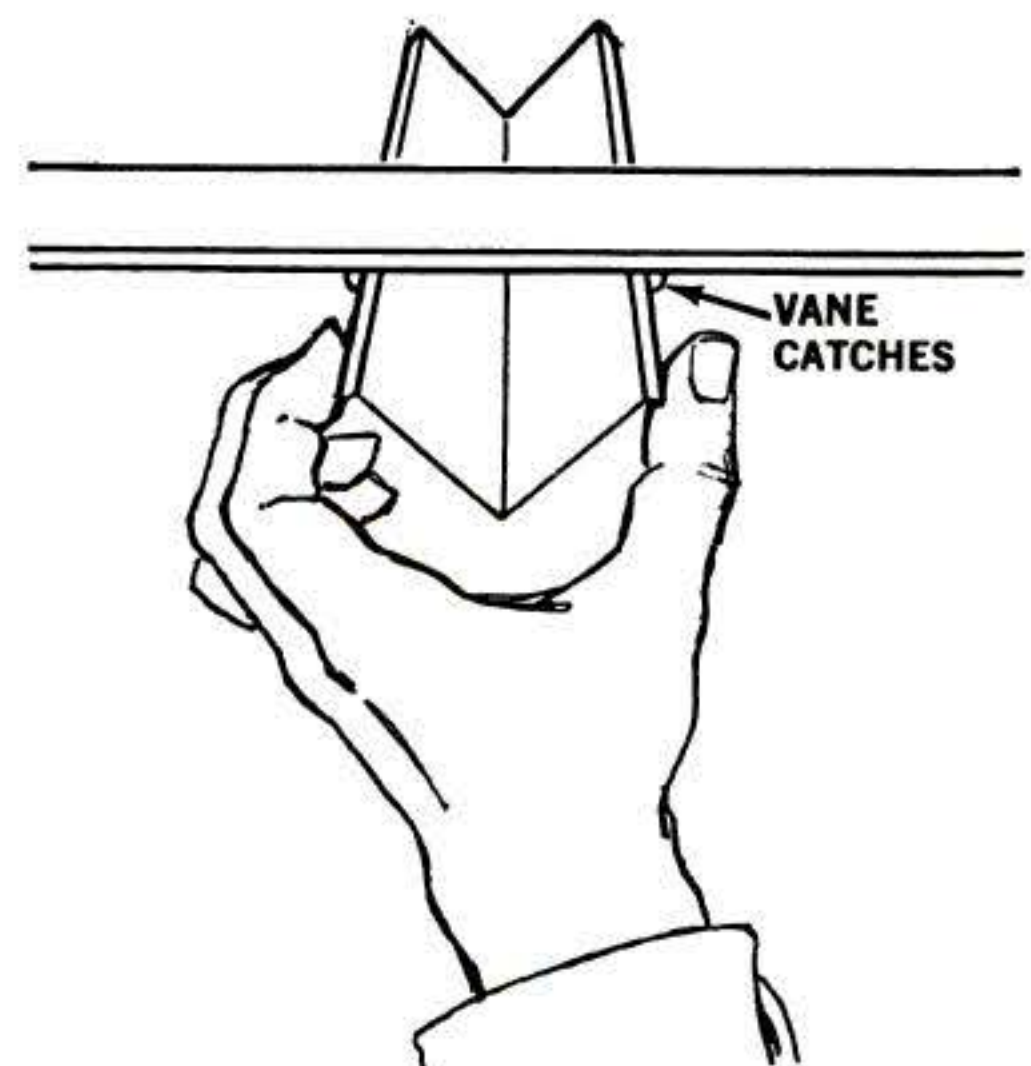
The strips fit between the slats, and knob-like lock-in clips hold them in place. Pinch the clips and they snap in, much like the slats. Just make sure the clips don't end up on top of support runners—they won't fit. For a flashy zebra-stripe look, alternate the colors of slats and strips, or put different colors on various wall and ceiling surfaces.

The paneling is expensive—compared with wallpaper or paint: about 6½ cents a foot for slats, 16 cents a foot for support runners. You need at least three runners per wall (a ceiling takes more, depending on size). It would cost about \$135 for four walls of a 12-by-15-foot room. The vanes come in 10-foot lengths, but you can get them cut to fit normal eight-foot-high walls. Or you can cut them yourself with scissors.

Nice thing about the paneling: It's easy to remove to get at wiring, fix-

tures, or walls (should you ever have to). Or, if a vane gets damaged, you can snap another one in.

The system is made by Levolor-Lorentzen, Inc., 720 Monroe St., Hoboken, N.J. 07030.—*Douglas Garr*



Here's how to snap in a slat: Just pinch it on the edges and slip it into the catches. Pinch again the same way to take it out.

Now: No-Guess, No-Mess Custom Color Paints

If you're gradually accumulating a full wall of half-empty paint cans (and paint you'll never use again) you'll be interested in one of the freshest ideas to hit the paint market: tubes of colorant you can use to mix the exact quantity you need in a great range of popular colors—all from one can of white paint.

What's new about tubes? What's new is that each tube gives you a color you want. You don't have to buy three or four tubes of pigments and intermix them—perhaps still not getting the shade you want.

What paint makers call "standard" colors come at minimum in half-pints in glossy enamel. Semigloss bottoms out in pints. You can, of course, buy any color on earth from

a dealer who does custom mixing, but again the smallest size is a pint in oil-base materials and a quart in latex. Okay—but much of the finishing and refinishing around the typical house involves projects that are less-than-pint-size.

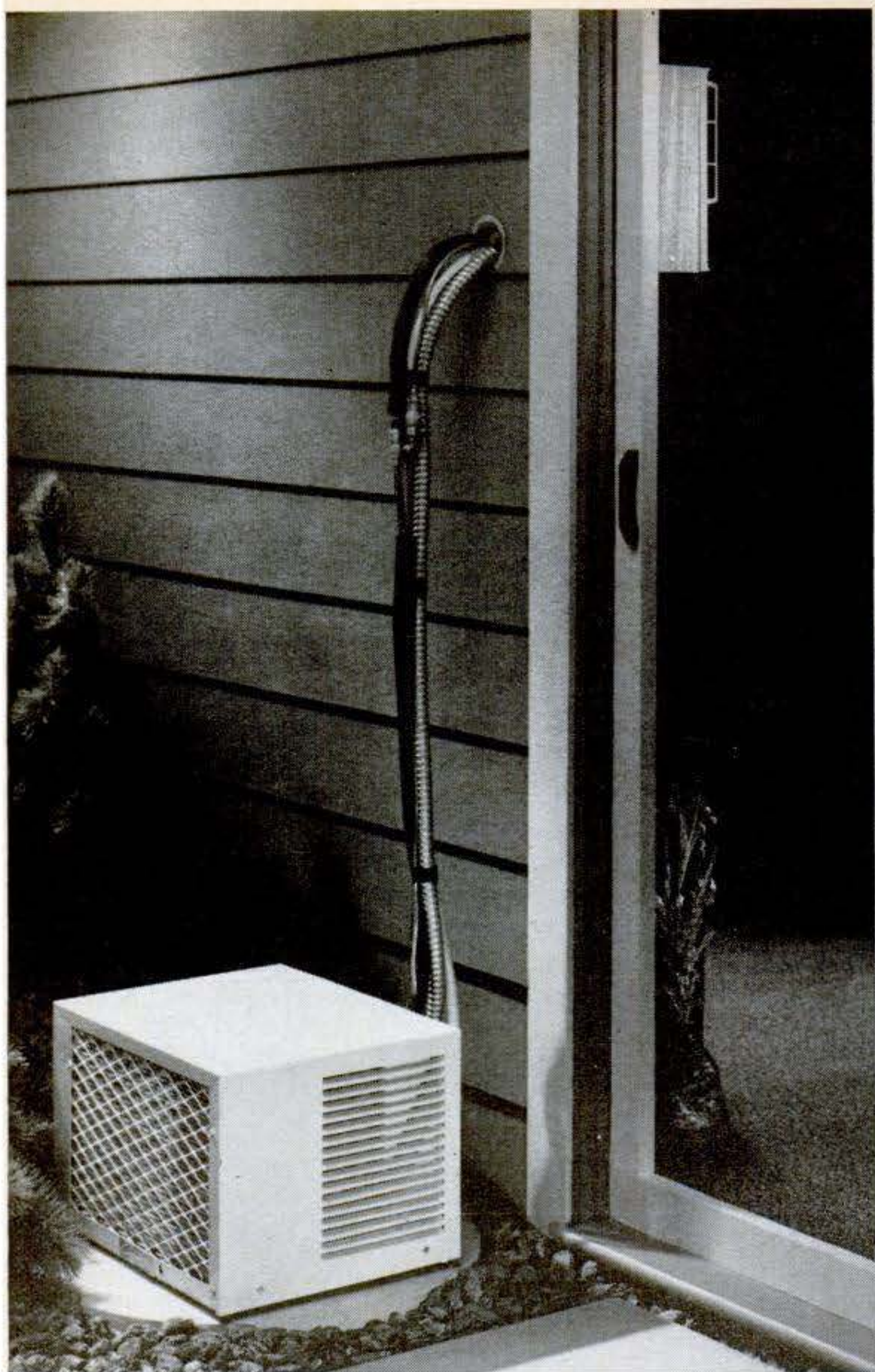
Using the new color idea from the well-known "Tints-All" line (Sheffield Bronze Paint Corp., 17814 Waterloo Rd., Cleveland 44119), you buy a quart of the enamel that you like to use. Pour into a small can as much of the enamel as you'll need for your planned job. Tint it with the new pigment to the depth of the color you want. There's no useless leftover.

You can use it in all latex and oil-base paints and enamels. It even

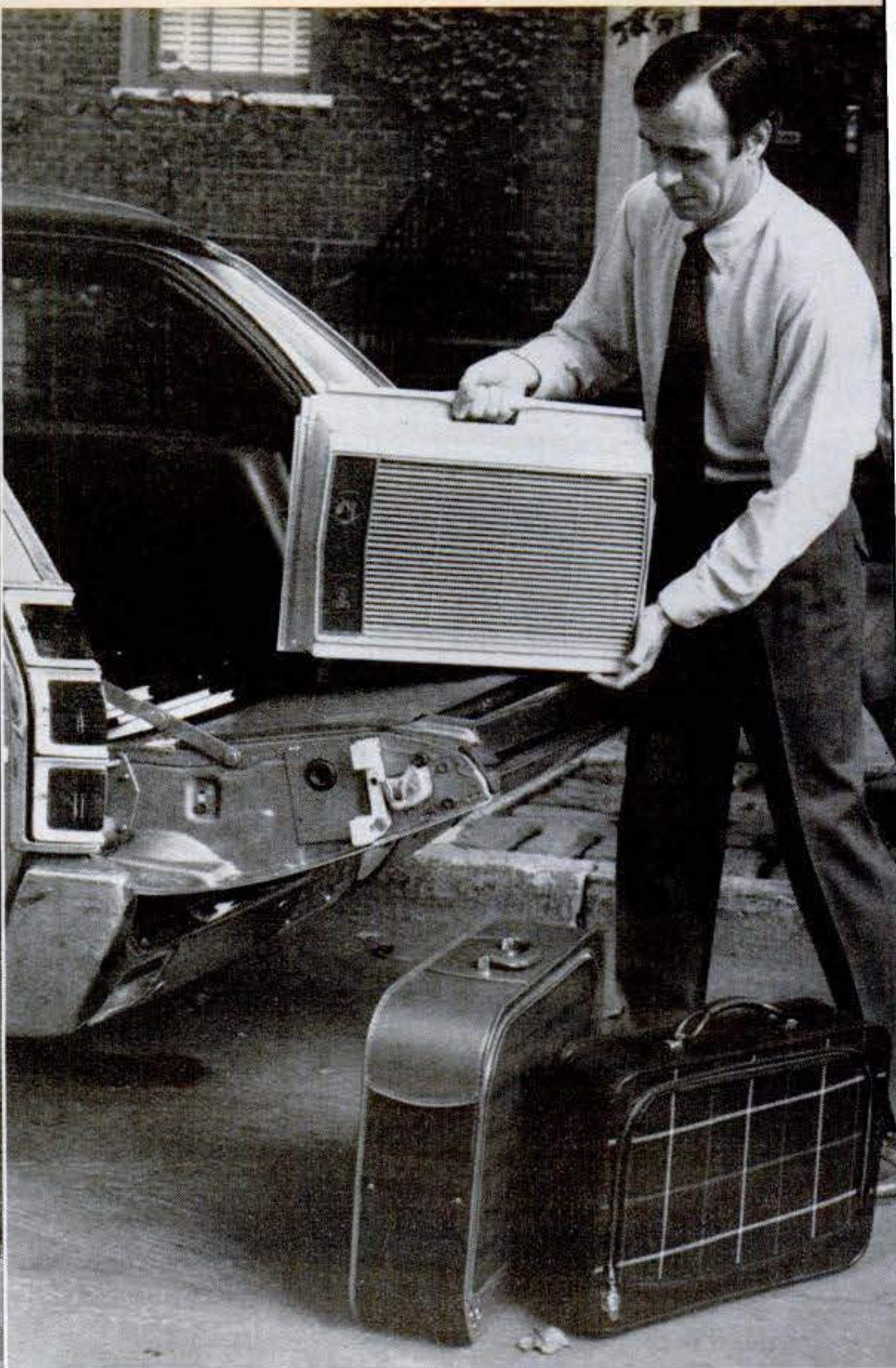
works in lacquers, although there may be slight color changes due to the solvents used in lacquer. Sheffield recommends only that you use a good-quality material.

You can choose from 34 different colors. They provide a great range in yellows, blues, greens, browns, and muted reds. True red hues aren't available. Nine of the colors contain lead, making them unfit for use on nursery walls, juvenile furniture, or toys. Check the labels for these.

One drawback: Although the colors are crisp and clean, there is a limit to the intensity of color since—as is true with any additive pigment—adding too much pigment to the base slows drying and reduces water resistance.—*Jackson Hand*



Heat Controller's Twin-Pac is a room unit cut in half. You need only a 2½-inch-diameter hole for through-the-wall installation.



GE's Carry-Cool weighs only 43 pounds. Chassis and frame are plastic with a built-in handle on top. The 4,000-BTUer costs \$100.

Cool News for '72: New Air Conditioners

They're shrinking fast, taking up less and less of your window area. And there's a new type in the works that could make future units super-small and super-quiet

What's your biggest complaint when you go to buy an air conditioner? They're too big and bulky? Too heavy? Much too noisy? None of these? Ah—they clutter up your window.

Well, you can relax now. This year you can get something *besides* cool air from room units. The '72 models are less conspicuous than ever, and there's news about everything from unusual shapes to new engineering technology in room and central systems. Here's a quick rundown of what's happening:

Novel designs. New room units are smaller, easier to carry, and much

more generous with the view outside your window.

Noise control. All the companies talk of "ultra-quiet" units, but there's no way to tell what they'll sound like in your bedroom window. The industry's self-regulating agency, AHAM (Association of Home Appliance Manufacturers), is working on a program to help you compare one unit's noise with another's, and even tell you how loud any unit will sound *in* your window.

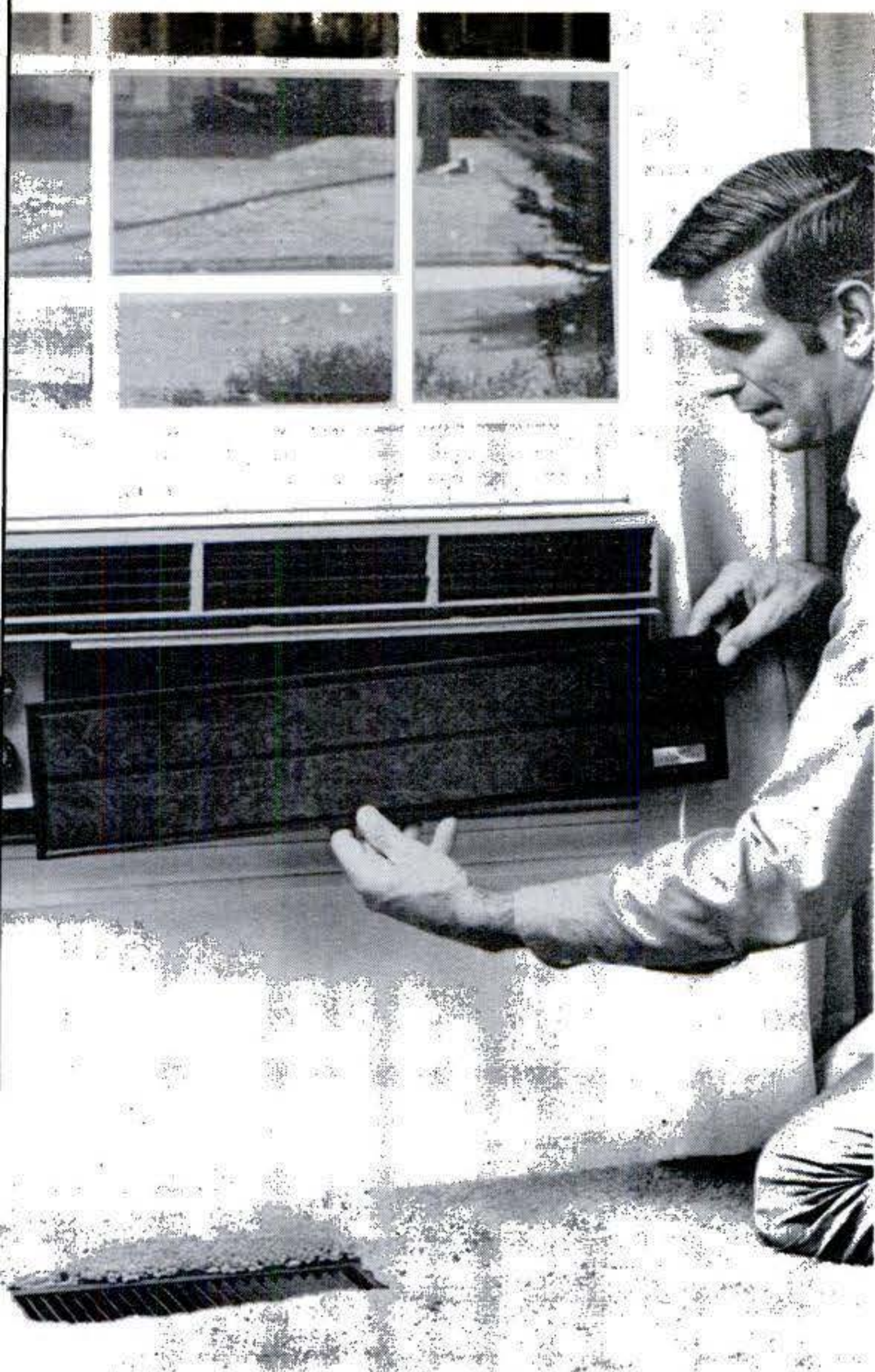
New technology. The rotary heat exchanger, a new concept in air-conditioning, is moving from the drawing board to the factory. It could mean

that future room units will be super-quiet and smaller than ever.

Cold storage. Air conditioners have been fingered as a major contributor to blackouts and power shortages because they draw so much current during peak periods. A new development may allow central systems to "store" cold at night and during low drain periods. They'll use less current during hot afternoons but deliver just as much cooling power.

Let's take a look at these new developments, one at a time.

The new room units. The most unusual-looking window model for '72 is Montgomery Ward's Silent Knight. "Half-in and half-out," the unit is split in two, compressor and condenser outside; evaporator, fan, and filter inside. Both sections hang *below* the windowsill so you get a clear view outside. Only obstruction is a small



Sears Viewsaver has front panel that reverses to match your room. It's only 10 inches high, weighs 80 pounds, puts out 6,000 BTUs.



Montgomery Ward's Silent Knight gives you the best view out the window of all '72s. Half-in and half-out, it's hung over the sill.



Are Outasight By DOUGLAS GARR

duct connection between inside and outside units. Two models, 6,000 and 9,000 BTUs, cost \$190 and \$230.

Sears' engineers also attacked the consumer's complaint of "cluttering up the window." Their compact view-saver, although it covers more window than Ward's is only 10 inches high, so you get a better look at your lawn than with your present air conditioner. It weighs 80 pounds and is 15 inches deep; Sears claims it's the smallest half-tonner (6,000 BTU) on the market. It costs about \$190.

General Electric's new room unit is the first true "mini-conditioner." At 43 pounds, the Carry-Cool is the lightest model around.

Secret of this lightweight unit? A small, 12½-pound compressor. GE's compressor is a rotary-type (which takes up less space) instead of the conventional piston compressor used

in most other room air conditioners.

Heat Controller, Inc. (1900 Wellworth Ave., Jackson, Mich. 49203) has a unique room unit, too. The Comfort-Aire Twin-Pac is cut in half. The condenser/compressor unit sits outside your house on a concrete slab; the indoor cabinet (evaporator unit) is mounted against the wall. Eight-foot, precharged refrigerant hoses connect the two sections.

Advantages? An inconspicuous cabinet indoors; and some of the noise stays outdoors. Disadvantages? Installation's a hassle and prices are hefty: about \$220 (6,000 BTU), \$330 (10,500 BTU), and \$365 (15,500 BTU).

Noise control. There's a lot of high-pressure advertising of "noiseless" room units—but very little action. Better insulation, baffles, and solid front panels reduce noise somewhat but

they don't eliminate it completely.

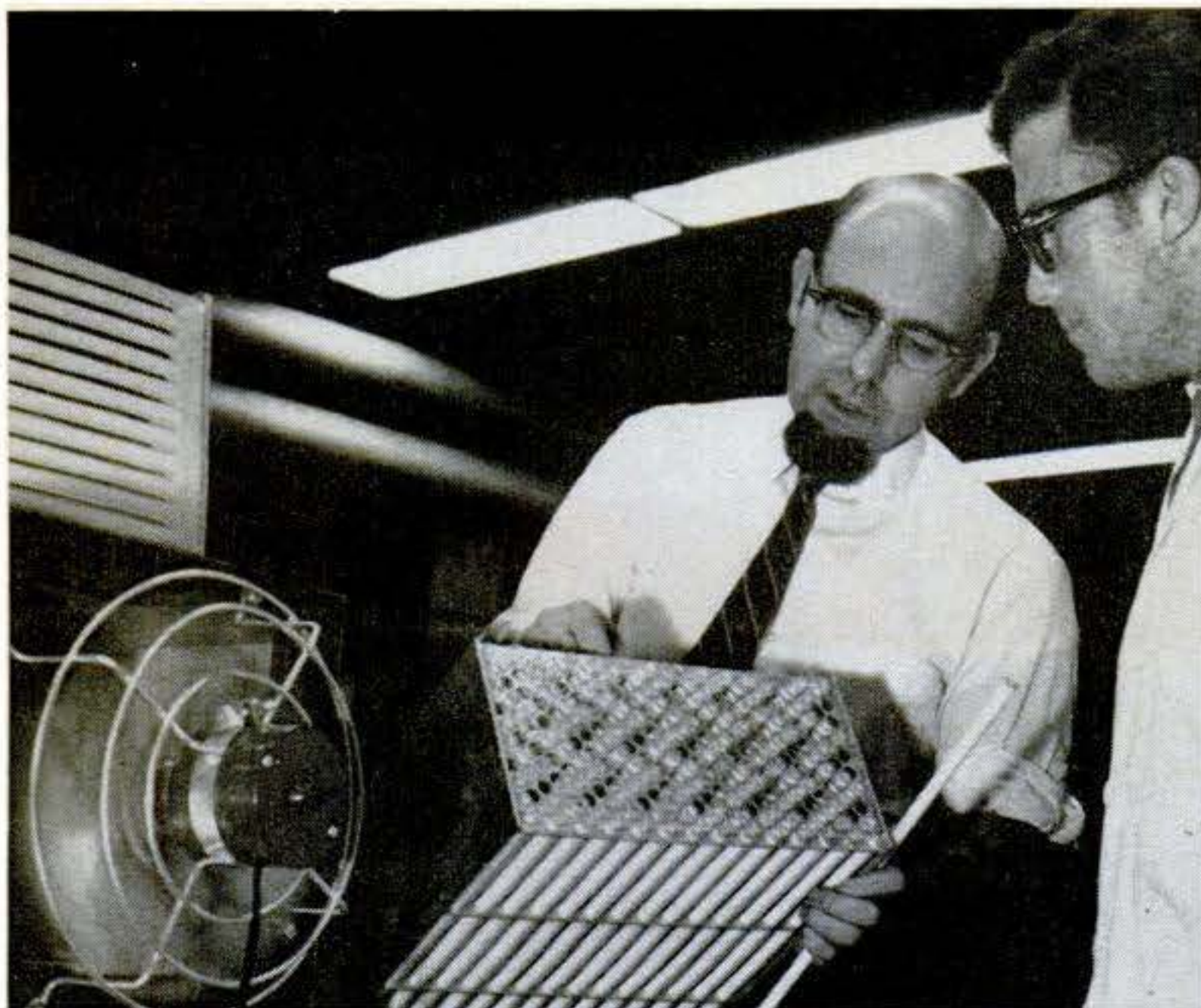
"Everybody says their unit's quiet, but you never really know until it's in your bedroom window," says James C. Wrench, a Carrier engineer.

How do you tell how noisy your air conditioner is after it's in your house? John Weizeorick, assistant technical director of AHAM, explains the problem:

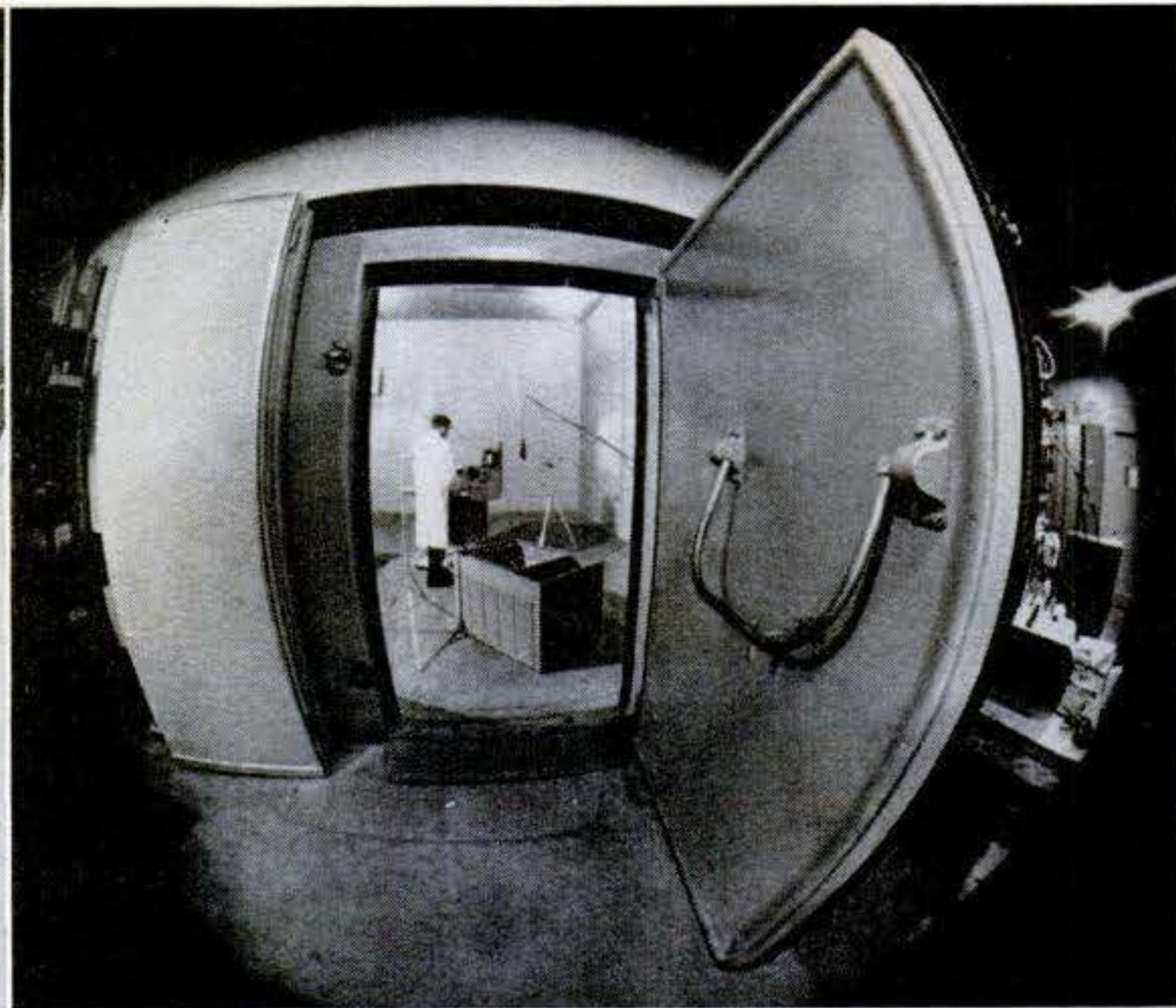
"Take an air conditioner with a given sound-rating number. Put it in a completely hard room—hard walls, ceiling, and floors. It will probably be noisy and annoying. That same air conditioner in a room with heavy drapes, rugs, and furniture may be very quiet."

AHAM is developing a new sound-rating method that will tell you how noisy your room unit will be *after* you install it, as well as how it compares

Continued



Chief engineer Steven Freedman displays $\frac{3}{8}$ -inch-diameter plastic tubes, the key to "cold-storage" central system. Tubes hold special salt crystals that freeze at 52 degrees F to form "engineered ice."



Fedders' "reverberant room" is used to study noise emissions of central and room units. Completely soundproof, it's a room-within-a-room. With 10-inch-thick walls, room weighs 250 tons.

with other units with similar cooling capacities. Weizeorick says it will work something like this:

You'll get a unit's sound-rating number and put it in a formula that takes into account such factors as wall sizes, windows, doors, rugs, and furniture. From that you'll learn how much noise (in dbA's) you have to put up with to stay comfortable.

AHAM's new noise application standard will measure the sound a room unit makes outside your home as well as inside. AHAM isn't certain when the new standards will be ready. Hopefully, you'll be able to compare noise in room units in two years.

Meanwhile, they sound much alike on the dealer's floor. The industry's challenge, according to a spokesman from Fedders, is "to make them small and light, yet quiet."

An exciting new development. You may recall a PS story [Mar. '71] about the Donbar rotary heat exchanger. Its application to room units could revolutionize the industry. The main feature of the unit is a compact combination heat exchanger/blower with hollow blades through which Freon travels. The evaporator and

condenser are shaped like cylindrical fans instead of ordinary coils. This results in greater efficiency and slower speeds—which could be the solution to the noise problem.

The rotary-heat-exchanger air conditioner will be smaller than conventional units, too. At press time, Donbar was negotiating a licensing agreement with a major American company to make room units. The company's name was not disclosed, but Donbar did say it would be making 12,000-BTU units for prefabricated homes. Dimensions? Two feet wide, one foot high, and one foot deep—really small for a one-ton unit.

Donbar has already licensed a Japanese firm to manufacture room air-conditioning units and the Trans-temp Division of Texstar Corp. to make automobile air conditioners, should it prove feasible. The Evans Products Co., another licensee, hopes to have rotary-heat-exchange air conditioner/heaters on mobile homes, RVs, and campers by summertime.

Cold storage. Store "coolness" in an air conditioner? Yes. It could play a big part in the solution to blackouts and power shortages in large cities.

The University of Pennsylvania's National Center for Energy Management and Power is developing a central air conditioner that uses "thermal-energy storage" (TES).

The key to thermal-energy storage (cold storage in this case) is special salt crystals that freeze at 52 degrees F. By running the system during off-peak periods, the unit can store up coolness in these crystals.

Dr. Steven Freedman, chief engineer on the project, calls the system a "thermal flywheel." The system minimizes the power demand on hot summer afternoons. Freedman expects to have a 12,000-BTU prototype ready in a few months. He says: "During peak conditions it will provide 21,000 BTUs of cooling capacity, yet draw the equivalent amount of power of a 12,000-BTU unit."

Why not TES for room air conditioners? Freedman says they'd be too big and bulky. And they'd have to be used on a large scale. Friedman says that for the TES cold-storage air conditioner to conserve the nation's power, millions of these units must be installed in power-shortage areas during the next few years. PS

Efficiency and your room unit

What is efficiency in an air conditioner? It is a measure of the amount of coolness your unit produces for every watt of electricity it uses, and is expressed in BTUs per watt. Compute the efficiency of your unit by dividing watts into BTUs. For example, if an air conditioner has a rating of 800 watts and 4,000 BTUs, its efficiency is five BTUs/

watt. This efficiency index usually ranges between four and 12. Generally, the higher the unit's cooling capacity, the higher its efficiency is likely to be.

What is a good efficiency number? Well, the higher the better. But you have to compare units with similar cooling capacities. An efficiency of seven is high for a 4,000- or 5,000-BTU portable, but low for a 10,000-BTU model. Example: Fedders has a 4,000-BTU unit with a

rating of 575 watts. Its efficiency is about seven BTUs/watt—which is fairly high for a small unit.

Should you buy a high-efficiency unit? It depends on how many hours you'll use it. They cost more, but use less electricity than low-efficiency units of equal cooling capacities. If your city has a lot of hot days, it pays to get a high-efficiency air conditioner. It shows that you're ecology-minded, too.

Idyllic garden setting at right was a traffic-worn patch of bare ground (below) before the author went to work. Cheerful white fencing and gate treatment are keys to visual impact.



Protected Plot for Gardening

Does your garden share a backyard with your wife, children, barbecue guests, and a rambunctious dog? Well, there's just no way your best plants will grow unless you fence them in.

Before you start fencing, however, do a little planning. Attention to a few key details will result in a fence that adds to the beauty of your yard while it protects the garden.

My job was easy. Two sides of the little 6'-by-15' corner plot were already fenced. All that remained was to put up the other two sides and erect a gateway.

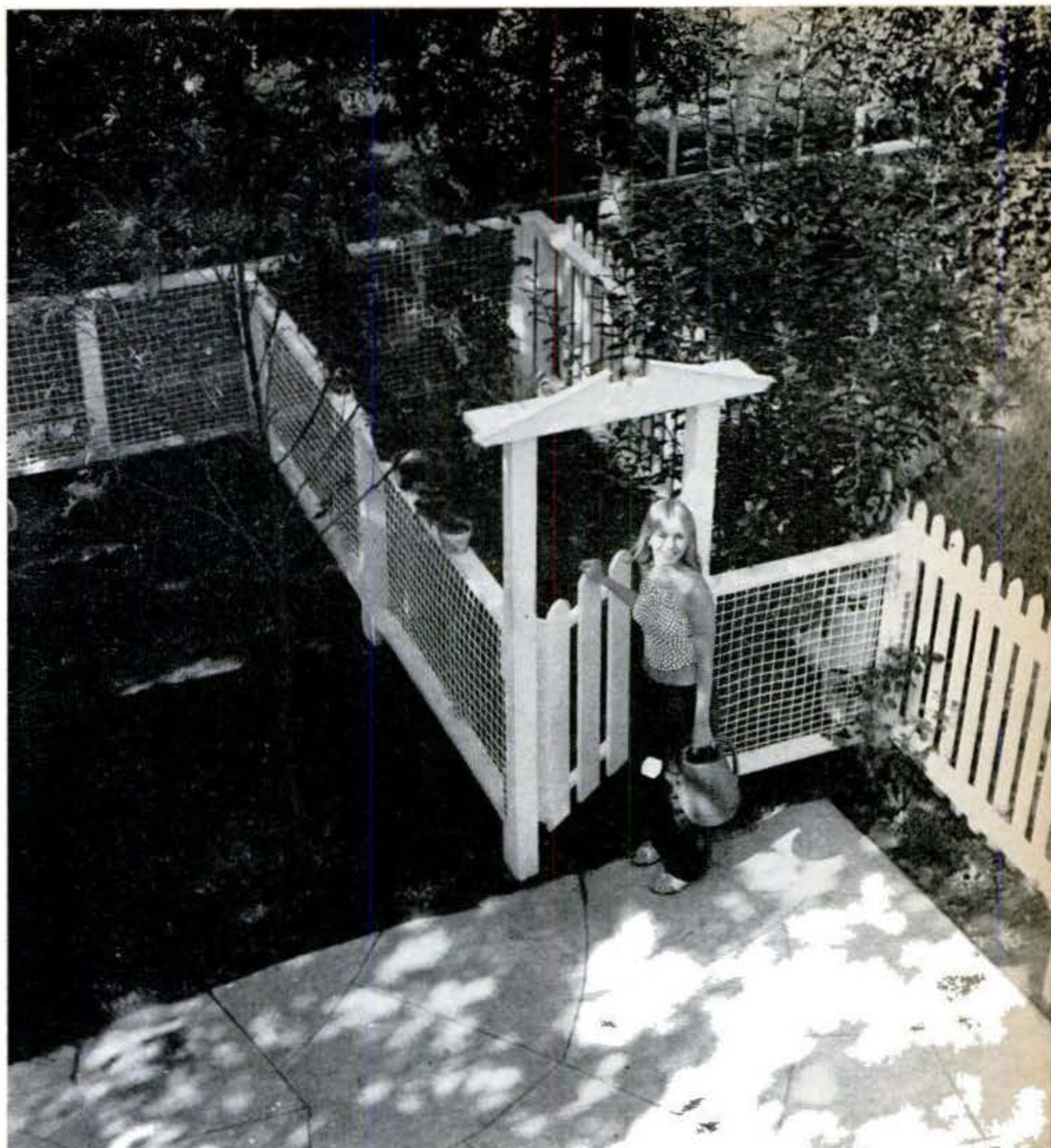
It started with latex-coated grille wire, 36" high . . . the stuff often used around the sides of an above-ground pool. It doesn't scratch children, doesn't rust, and it takes a coat of paint if you want to add color. It's easy to put up, too. You just staple it to the framing.

First, the framing details. Start with the posts. Use 5' 4-by-4s buried 18" into concrete footings. A post at 8' intervals gives you all the rigidity you need. Add a top rail of 2-by-4s nailed flat on top of the posts. Toenail on a bottom rail of 2-by-4s—between the posts—6" above the ground.

Now the gateway. Build this as a complete unit before you sink it in the ground. Cut a pair of 4-by-4 posts 8' 9" long. To the tops, nail the overhead crown detailed in the sketches. Tack a pair of temporary cross-braces between the posts to keep them parallel. If you put an extra brace with its bottom edge 80" below the crown, it will support the unit at the correct height when you drop it into place.

When built, set the gateway in its holes. Use a level to make sure it's vertical, then brace it in position while you pour the concrete footings. Keep the tops of the footings about 8" below the garden surface to allow small plants to take root at the bottoms of the posts.

Last comes the gate. Make a frame of 2-by-2 stock, sized to swing free and clear in the gateway. Then add a facing. The sketch shows the type I made—designed to blend with my fencing,

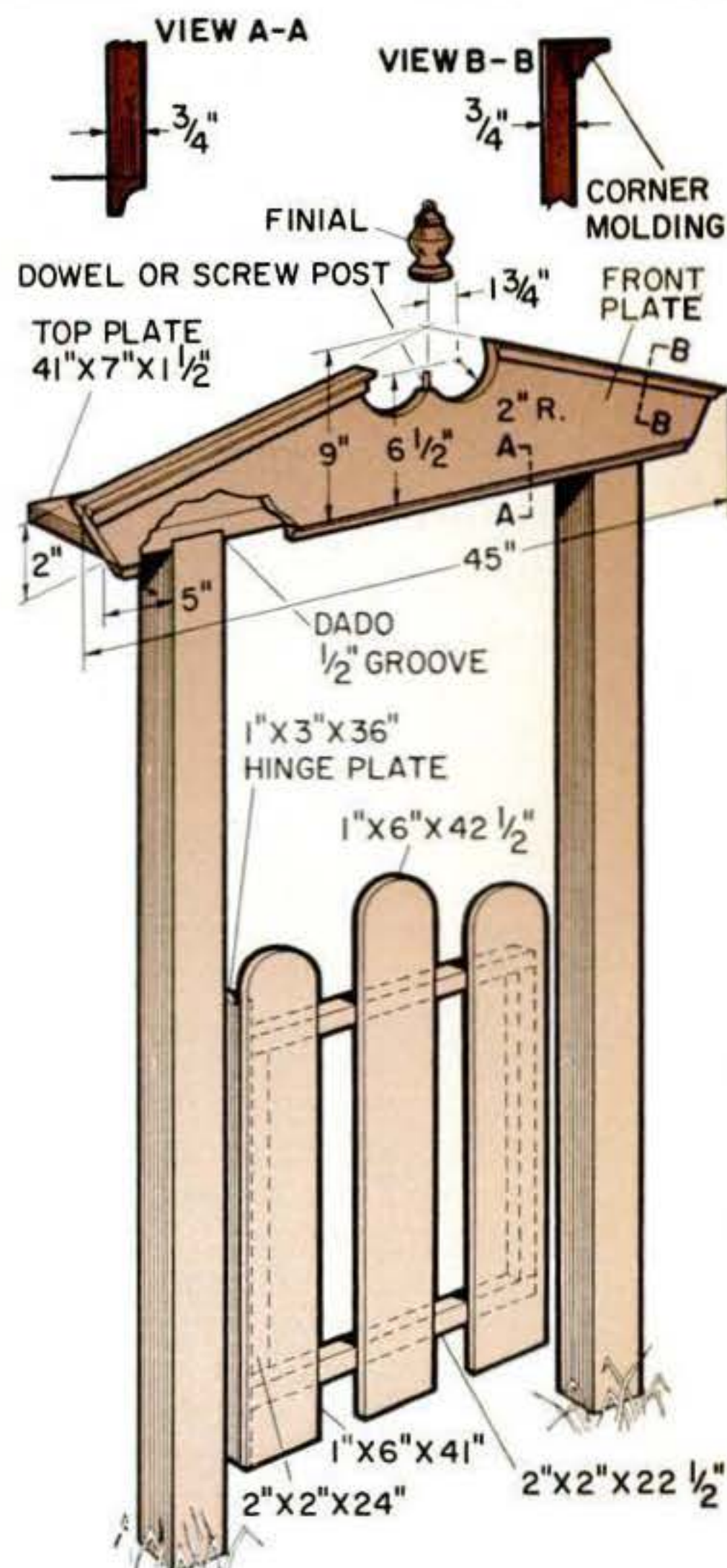


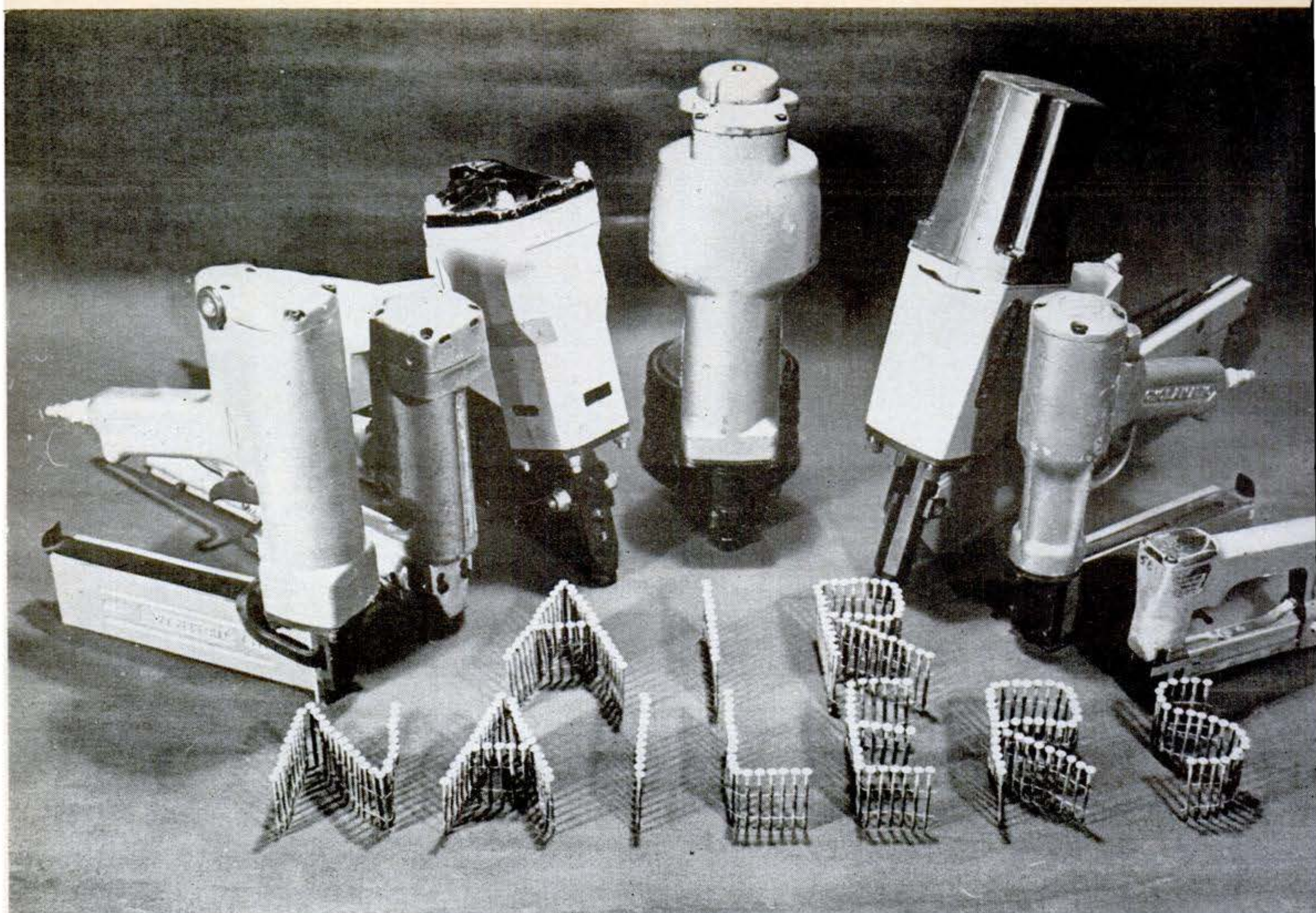
Assemble gateway as a unit before you drop it in place. Creosote on gateway and fence posts will keep them sound.

and with the picket fencing that runs along my neighbor's property line. You may want to change the design to suit your situation.

Hang the gate with its bottom edge flush with the bottom of your fence. Use brass hinges—a little oil now and then will keep them in shape, and they won't rust and discolor the gate.

Now a coat of paint brings a sparkle to the fence—and to the eyes of all who see it. If your planning is right, it's just about planting time.—K. Martin





Nail guns you may find at the rental shop: the Bostitch Mark III (stapler), Spotnail EAX (stapler), Duo-Fast CN-136 (nailer), Bostitch N3 (nailer), Model 816 Internailer, Bostitch CY (stapler), and Duo-Fast air tacker. In foreground are air-gun nail strips.

DRIVE YOUR NAILS WITH

Meet the pneumatic nailers, the hired guns that can help you build. Pick one up at your local rental shop

By MARION D. RICE

Planning a major remodeling job? Maybe an addition to your home? You'll save yourself a lot of time and work if you look into air nailers. Let me show you what I mean.

I'm a small contractor. Several years ago I was faced with a remodeling job out of town. To complete the job on time I had planned to hire two additional carpenters. Only one problem—I couldn't find any. In desperation I turned to a rental store for help.

For \$3 a day I picked up an air-powered gun that drives nails at well over 100 per minute. Result? I completed the job on time, saved about

\$400 on labor, and got hooked on air nailers. Today I own five.

You may have no need to own five air nailers—or even one. But any time you're faced with a big job, it may pay you to rent.

What is an air nailer? And how does it work? Basically all nailing and stapling guns operate on the same principle. Compressed air is applied to the top of a cylinder which contains a piston and driver blade. A tug on the nailer's trigger sets piston and blade in motion and the nail or staple is driven within a fraction of a second.

The depth of the fastener can be adjusted from flush to countersunk by several methods, such as regulating the air pressure or installing shims at the bottom of the cylinder to limit piston travel. The countersinking feature is especially desirable in finishing guns. It eliminates time-consuming hand countersinking.

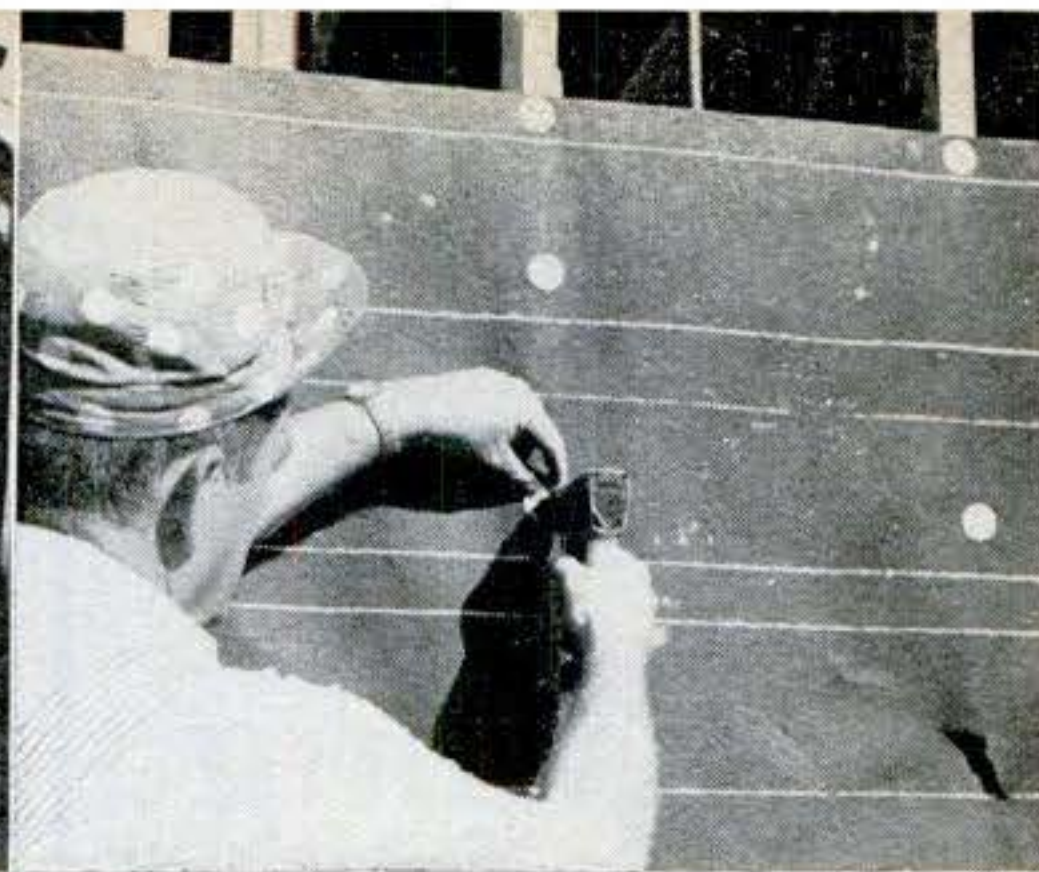
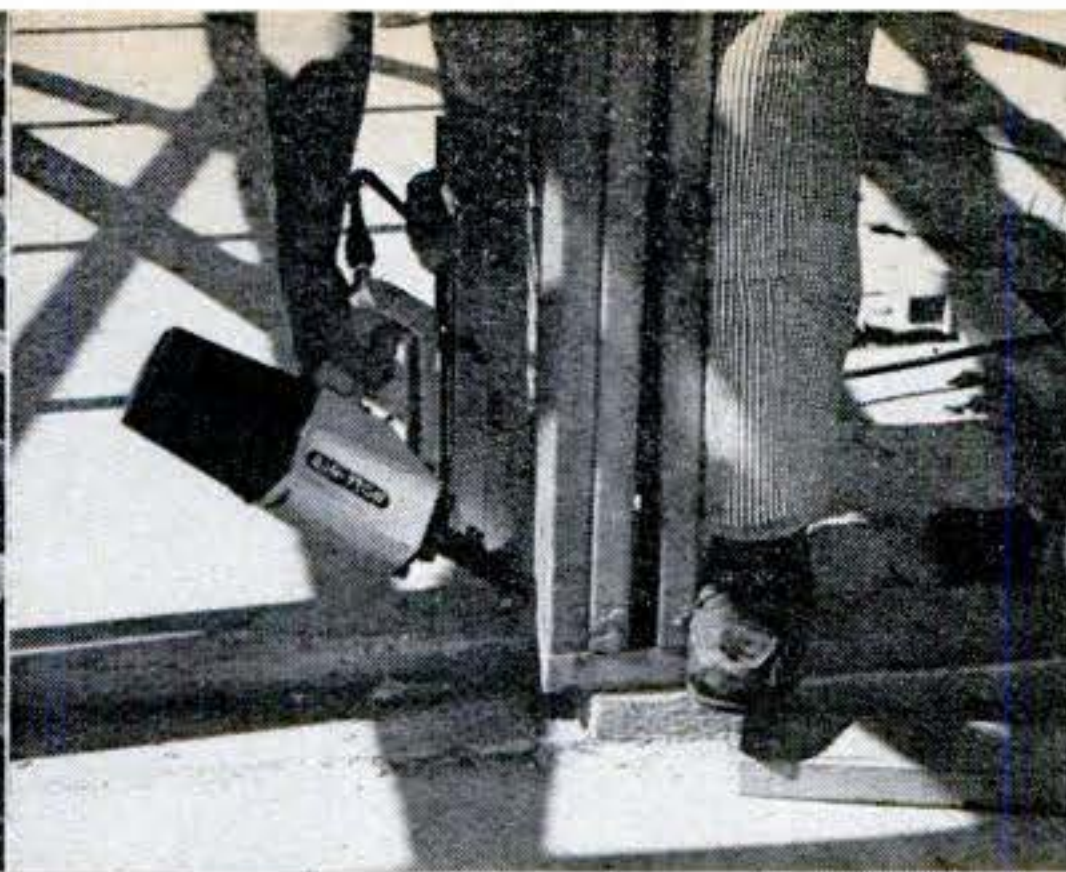
You can also adjust the guns to take a wide variety of nail sizes. That first gun that I rented could handle com-

mon roundhead nails from 6d to 16d.

There is an air nailer or staple gun for just about every nailing operation done with the conventional claw hammer. The nailers are not only fast, they can improve your work. There are none of the hammer marks sometimes found on door, window, or base trim—and splitting of the wood is kept to a minimum. You seldom bend a nail or staple, regardless of nailing attitude or position.

Nailing problems are a thing of the past. The greenest amateur can become a professional in a matter of minutes when using these tools. The really hard jobs—nailing overhead, in corners, in confined places, in the dark, and even under water—become easy with a nail gun.

What about safety? These guns are usually designed to eliminate accidental firing. A bump-fire or touch-trip safety is located at the tip of the gun. It has to be in contact with material being nailed before firing will occur and then only when you pull

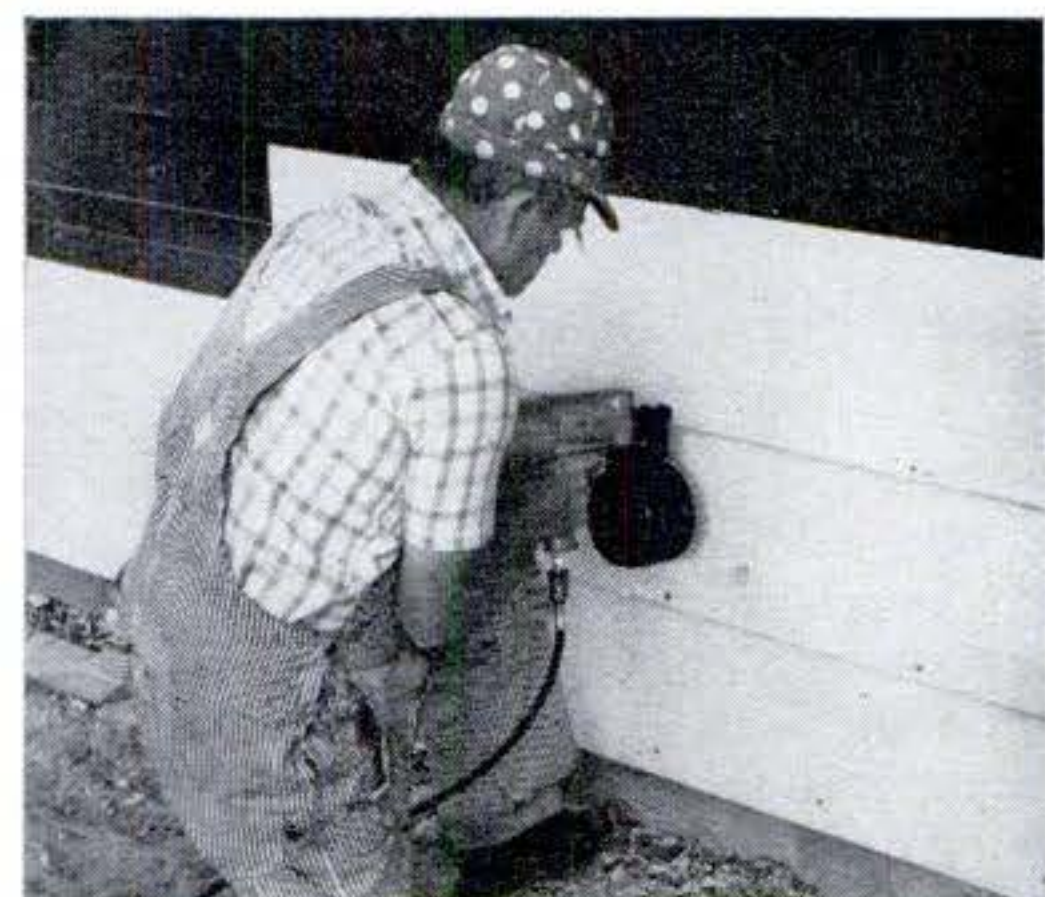


From foundation forms to roofing, nail guns speed the job

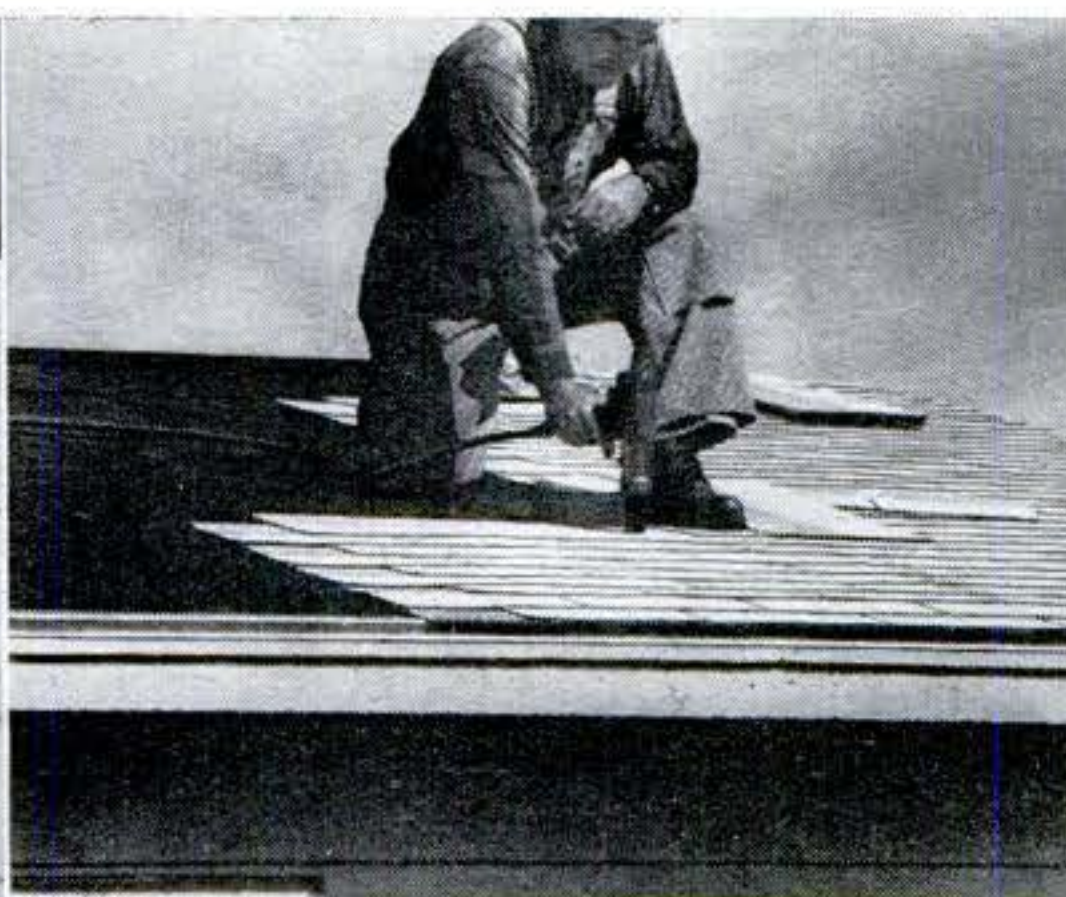
One-hand operation leaves other hand free to hold stakes in position while you nail. Result—a faster, firmer job of staking.

Air nailer is six times as fast as a hammer on framing. And marks like those made by a hammer on stud above are eliminated.

Duo-Fast air tacker drives $\frac{9}{16}$ " staples through metal washer with ease, making short work of installing building paper.



Siding goes up quickly with Bostitch N3 nailer. It's adjusted to drive nailheads flush with siding to eliminate puttying.



Less time on the roof—that's big advantage of an air nailer in roofing—a job that requires a great deal of nailing.



Nailing overhead or in awkward positions is no trouble with gun. Work goes faster and you can do neater job without tiring.

AIR

the trigger. If you accidentally pick up the gun by the trigger, it will not fire.

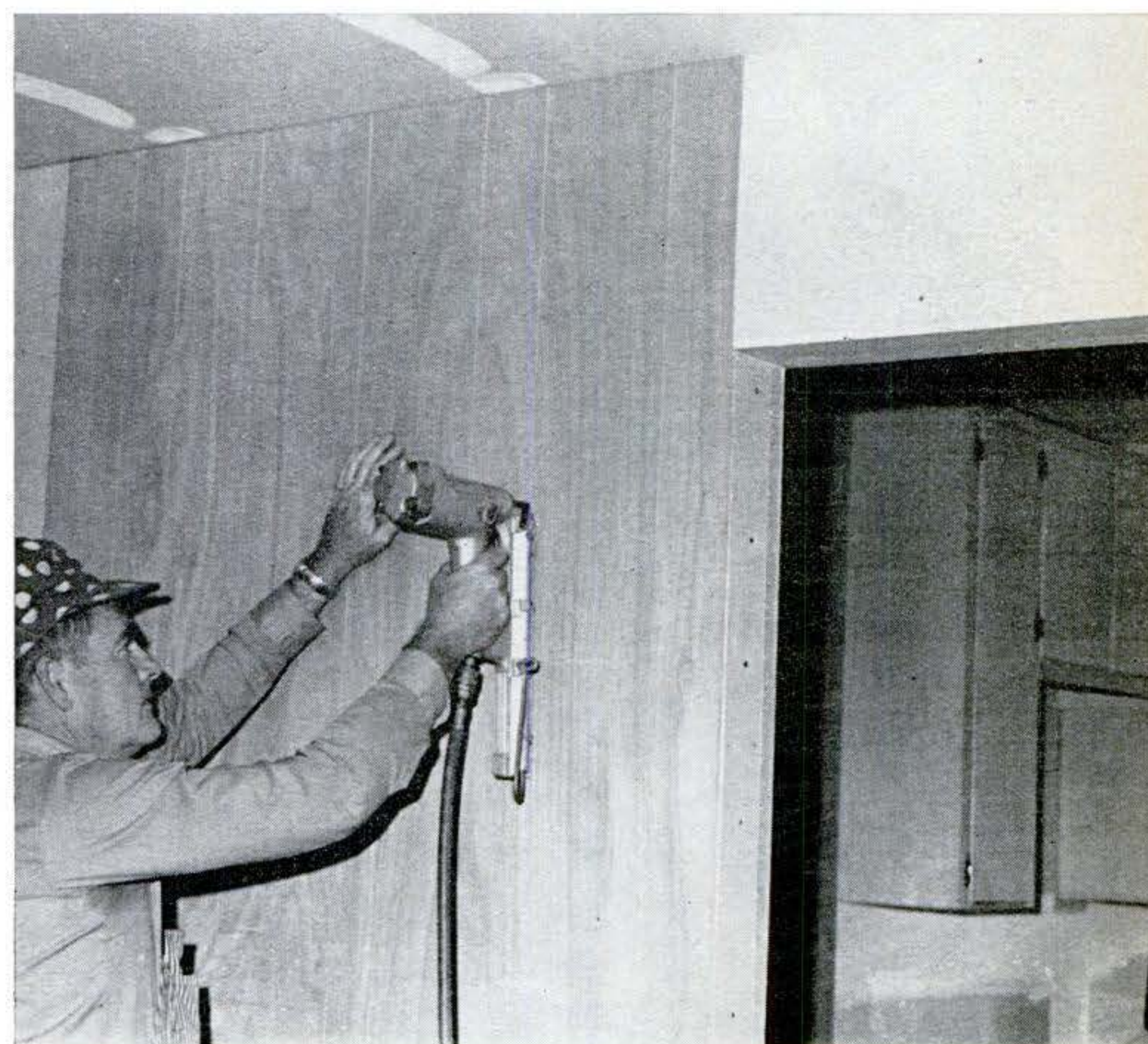
In use, these safeties actually speed up any nailing operation once you become familiar with them. They are found on nearly all the large nailing guns; however, the small staple and some finishing guns don't have them.

The nails. These come from the manufacturer preassembled, and it is rare indeed when staples or nails of one brand can be interchanged with those of another. Most of the round-head nails for use in nailers come in clip form, normally 25 to 30 per clip depending upon the diameter.

The nailer magazines will usually hold two clips. The Bostitch N3 nailer is an exception; here, round-head nails (6d through 8d) come in a coil form, held together by two small wires. This nailer will hold 300 6d or 250 8d nails without reloading.

T nails, finishing nails, and brads are available in strips, similar to

[\[Continued on page 138\]](#)



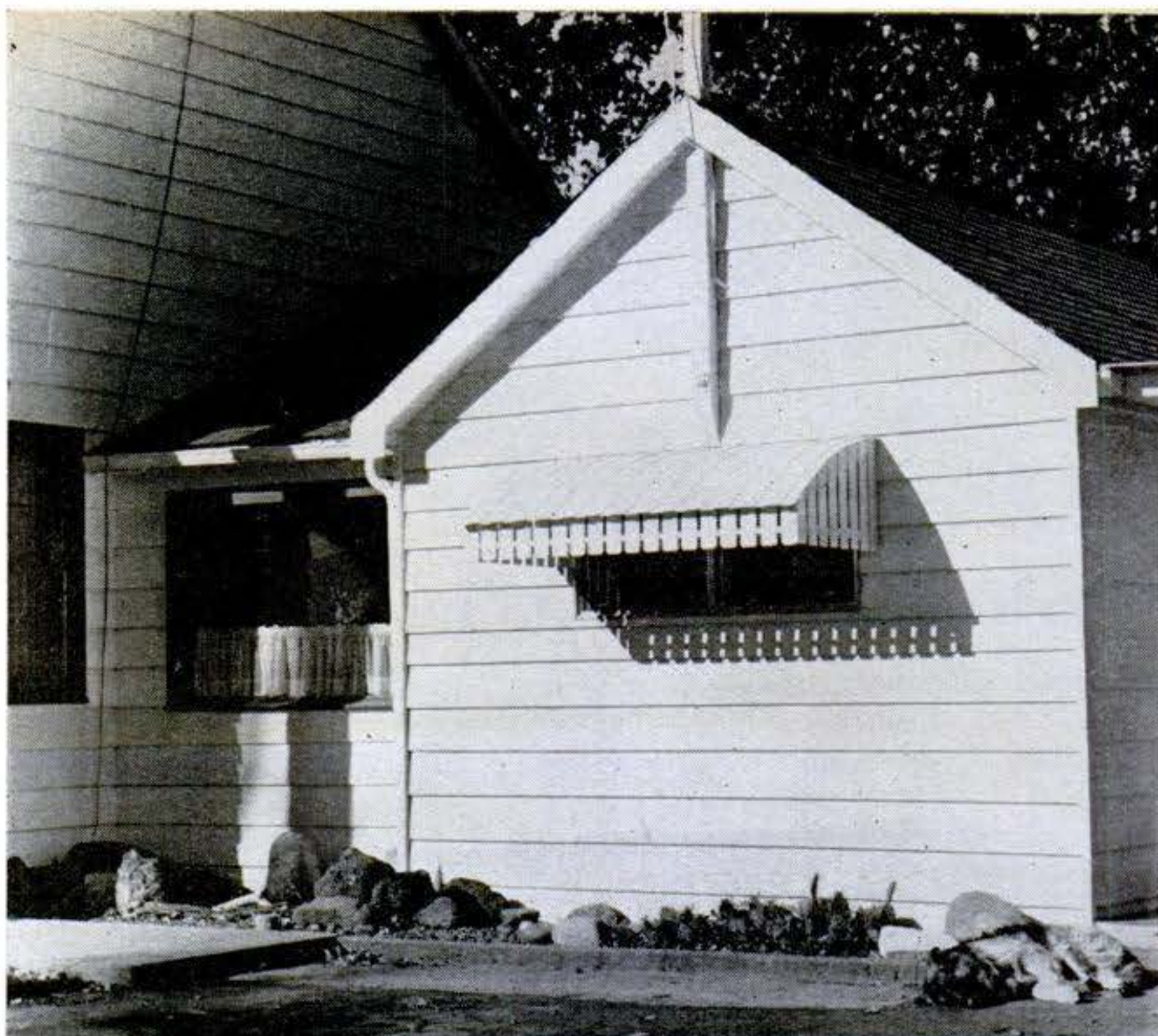
Finishing nailer (Spotnail EAX) drives, countersinks nails in a fraction of a sec-

ond. Spotnail offers special finishing brads color-matched to paneling and trim.



HOW TO MAKE An Awning for a Sunny Window

By GALE ENGER



An awning is an effective way to block the sun from a window. It can also add color to an otherwise drab outside wall or window. You can make this one from wood and hardboard for less than \$10 in materials cost.

Lightweight, functional, and extremely strong when mounted securely, the awning will last for years if given routine maintenance. The solid top will not collect dead leaves or trash when the wind blows, a disadvantage of the ventilated top of some metal awnings.

First, determine the length. Measure the horizontal distance between the outer edges of the window's sash, and allow $7\frac{1}{2}$ " more than this figure for the awning length—the distance from the outside of one end frame to the outside of the opposite end frame. This figure will also be the length of the three inside longerons. The mounting longeron and front longeron will be $1\frac{1}{2}$ " shorter than this because they are set inside the $\frac{3}{4}$ " endpieces.

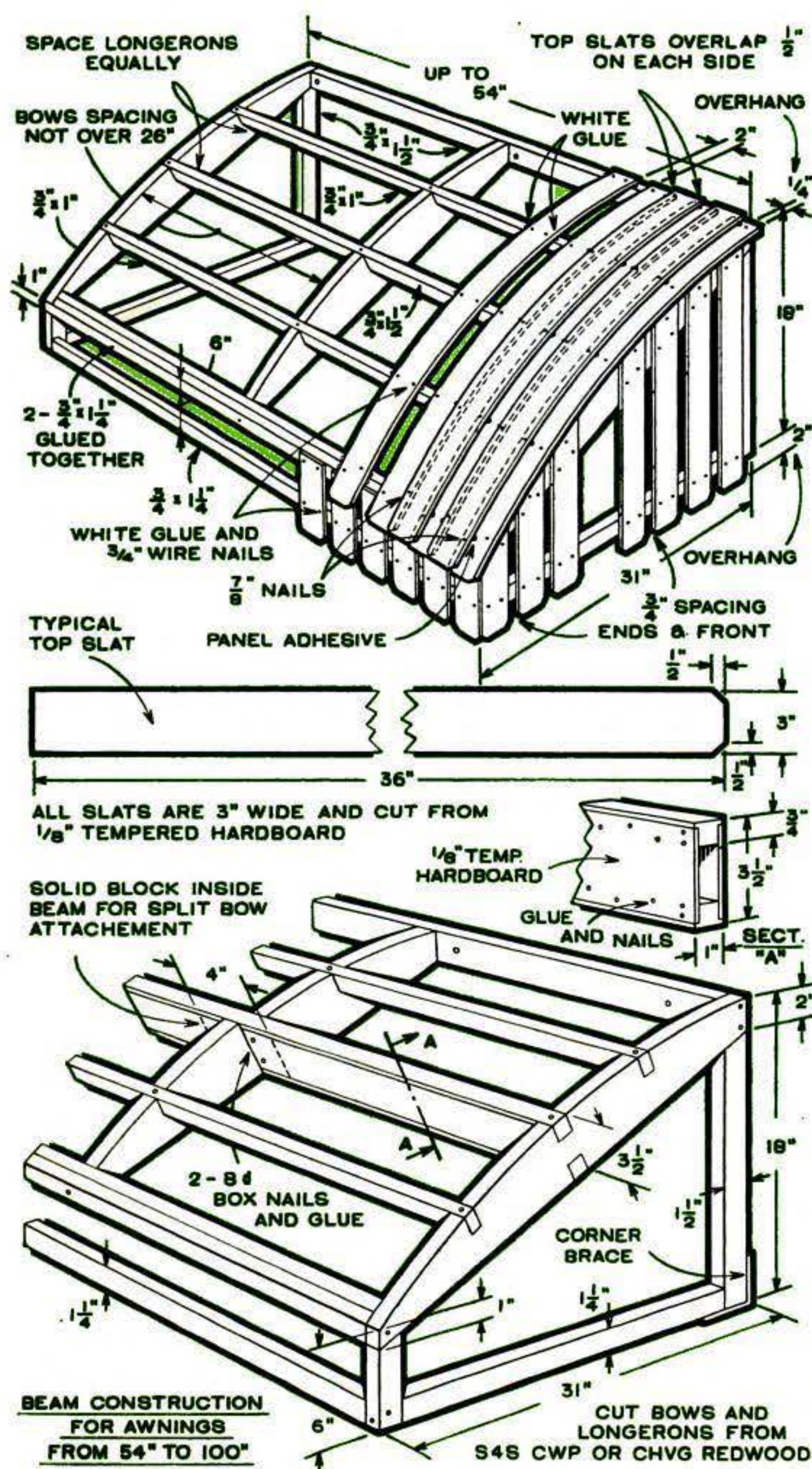
Alternate framing plans are shown at left. The top sketch is for windows up to 54" wide. The bottom sketch is a huskier, beamed frame for greater widths.

Kiln-dried, clear-heart, vertical-grain redwood is the most desirable wood for the frame. However, if you have time and like to shop, you can go to No. 5 white pine or No. 3 common spruce and cut the parts from between knots, saving money on materials. The bows can be cut from 1-by-4 stock. The $\frac{1}{8}$ " tempered hardboard for the slats comes with a screen back or smooth on both sides. The smooth back is better for painting.

Lay out an end frame. Make a full-size layout, using cardboard tacked to the workbench or a large sheet of plywood. To determine the arc for the top, bow one of the slats from one end to the other and trace along its curve. Rough-cut as many bow sections as you'll need, using the first as a template. Put one rough-cut bow on top of another and tack together with two finish nails. Stack up to five bows, and sand or plane to finish shape. Mark and saw out all notches for the longerons at one time.

Assemble the end frames next, using your full-size layout as a guide. Each endpiece will require eight slats 3" wide, varying in length from 10" to 20". Spacing is approximately $\frac{3}{4}$ ". Fasten the six center slats to the frame with white glue and $\frac{7}{8}$ " wire nails. Line up the bottom edges with a 2" overhang. The tops of the slats can be cut

[Continued on page 134]



PATIO ALERT Lets You Relax Outdoors

Wireless units tell you when something's happening inside

By RONALD M. BENREY

One problem with spending lots of time outside your home is that you may not be able to hear what's going on inside: the doorbell or telephone ringing, the baby awake and crying. Here's an electronic gadget—the patio alert—that offers a solution.

The system consists of four parts:

- A receiver/indicator you stand on a nearby table on your patio (or bracket to the wall, as shown in the sketch) and plug into any AC outlet;
- A trio of transmitter/sensors you place around your house to monitor anything that rings, buzzes, cries, or otherwise makes noise.

When a transmitter/sensor hears the sound it's waiting for, it transmits a signal along your home's power line to the receiver. (No wires to run.) Instantly, a buzzer sounds and one of three lights glows to tell you which transmitter is active.

How the system works. Each transmitter unit consists of two circuit stages: A sound-operated relay and a high-frequency oscillator. You can connect two types of pickup devices to the circuit:

- A miniature loudspeaker, which serves as a simple microphone to pick up any audible sound, or . . .
- A telephone pickup coil that responds to the electromagnetic field produced by bells and buzzers.

Either pickup can be connected to the transmitter circuitry.

When the pickup responds to a sound or magnetic field, the detected signal is amplified and used to actuate a relay. The relay then turns on a



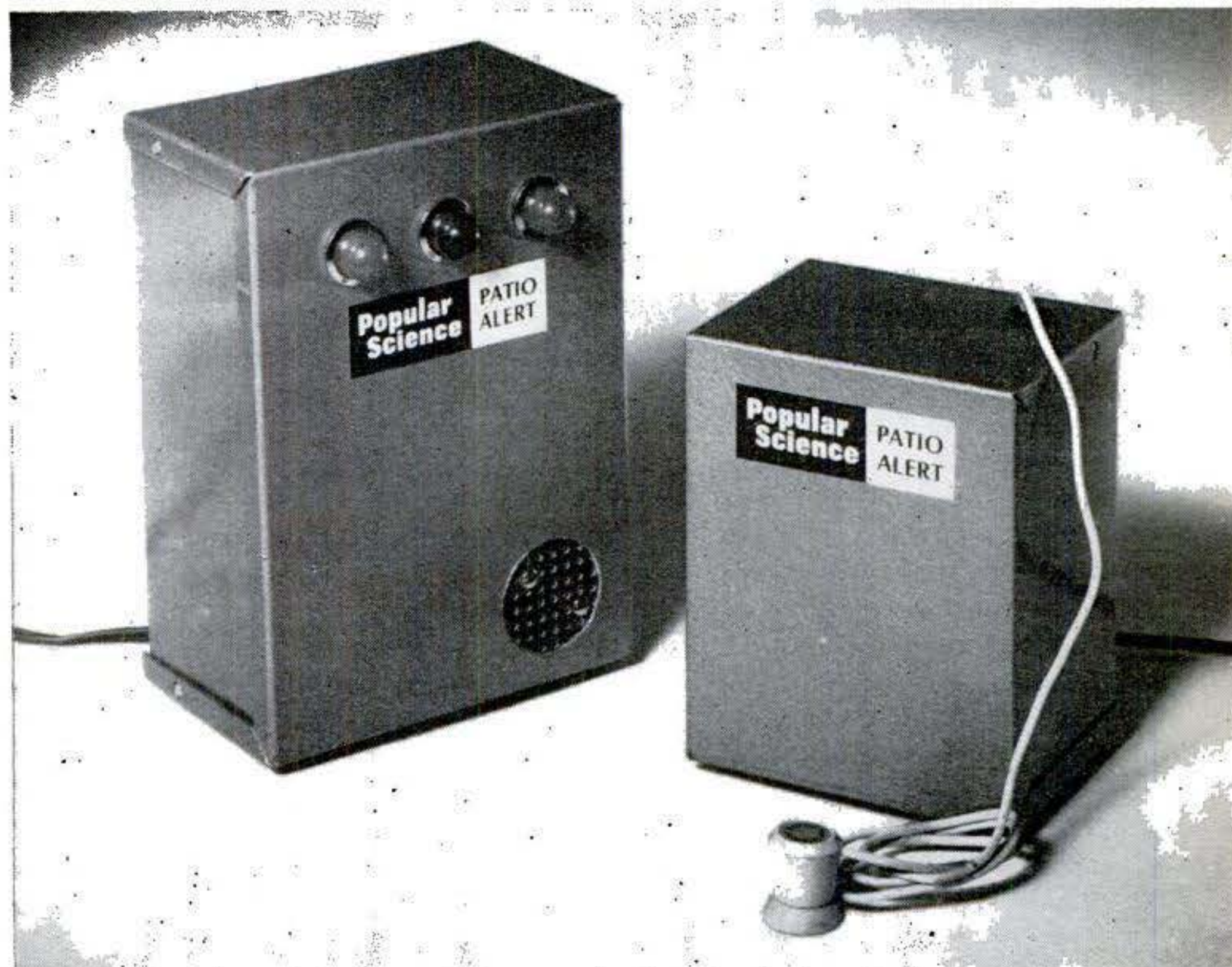
variable oscillator circuit, which is amplified and sent along the AC power line to the receiver.

One transmitter broadcasts at about 65,000 Hz (far lower than any radio

transmissions), one at 55,000 Hz, and the third at 45,000 Hz.

At the receiver, the high-frequency signal from any pickup unit comes off

Continued



Wireless receiver (left) buzzes and displays which transmitter (one of three is shown

at right) has been activated. AC house wiring carries all signals.

the power line, is amplified, and is sent to a trio of tuned circuits (L1/L2/C4; L3/L4/C5; L5/L6/C6). Each tuned circuit responds to a specific transmitter frequency—thus, only one of the tuned circuits will respond to the signal that is being received.

Output voltage from the particular tuned circuit selected is then used to light its respective indicator lamp and activate the buzzer. Thus, when a specific transmitter broadcasts a signal, the corresponding lamp glows at the receiver, and the buzzer sounds.

Building the transmitters. Each is housed in a 3"-by-4"-by-5" aluminum minibox. The three transmitter circuits are identical, so only one is shown in the diagram.

Mount all components (except transformer T4 and rectifier D) on a piece of perforated phenolic chassis board. Use push-in terminals as wiring and soldering points. Follow the exact parts layout in the diagrams.

Mount T4 and D on the top half of the minibox, as shown (use a terminal strip to hold D and to provide soldering points for T4's leads).

To connect the telephone pickup coil to the circuit, clip off the miniature plug that's attached to the unit, and connect the conductors to the circuit board. The inner conductor goes to T1; the outer shield to chassis ground.

Make the microphone pickup by soldering a length of twin-conductor hi-fi speaker cable to the terminals of a 2"-diameter miniature speaker. Then cement the speaker into the plastic cap of a discarded aerosol can.

Use the telephone pickup wherever possible. It can't be fooled by miscellaneous room noises. The microphone pickup is fine, for example, in the baby's room where the only sound will be the baby. Trying to listen for a telephone that happens to be next to a running dishwasher would be impractical.

The receiver. It is assembled in a 3"-by-5"-by-7" minibox.

A hand-wound transformer is used in each of the three tuned circuits. Wind with #28, 30, or 32 enameled-copper magnet wire; use 2" lengths of 3/4"-diameter wooden dowel as coil forms. Follow these specifications for winding:

Transformer #1: Primary—L1, 100 turns; secondary—L2, 200 turns.

Transformer #2: Primary—L3, 100 turns; secondary—L4, 200 turns.

Transformer #3: Primary—L5, 100 turns; secondary—L6, 250 turns.

Incidentally, be sure to identify primary and secondary winding leads so you can tell them apart.

Start by winding the *primary* coil. Build up a uniform layer of wire turns about 1" long. When you count off the required number of turns, wrap a layer of plastic electrical tape over the coil.

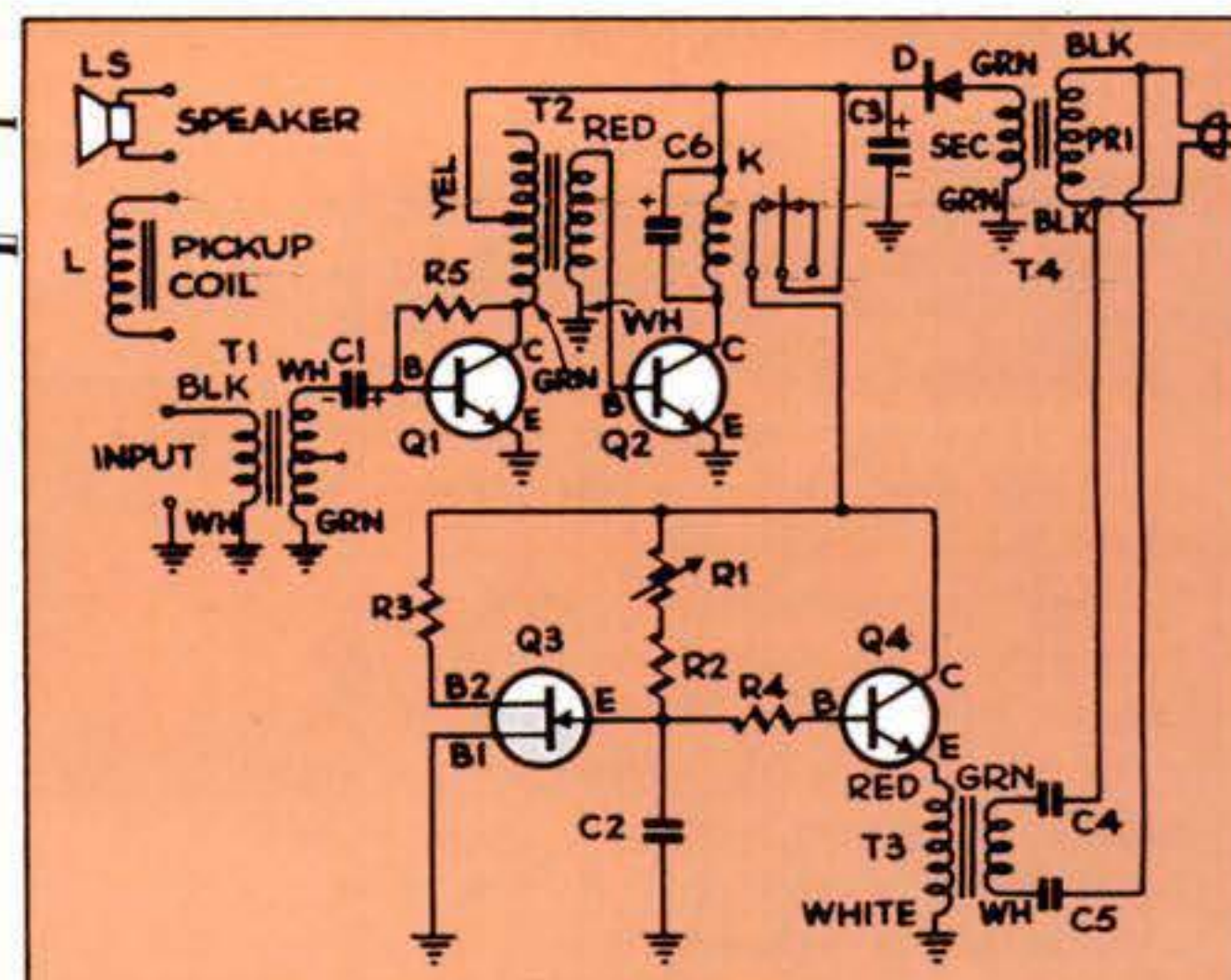
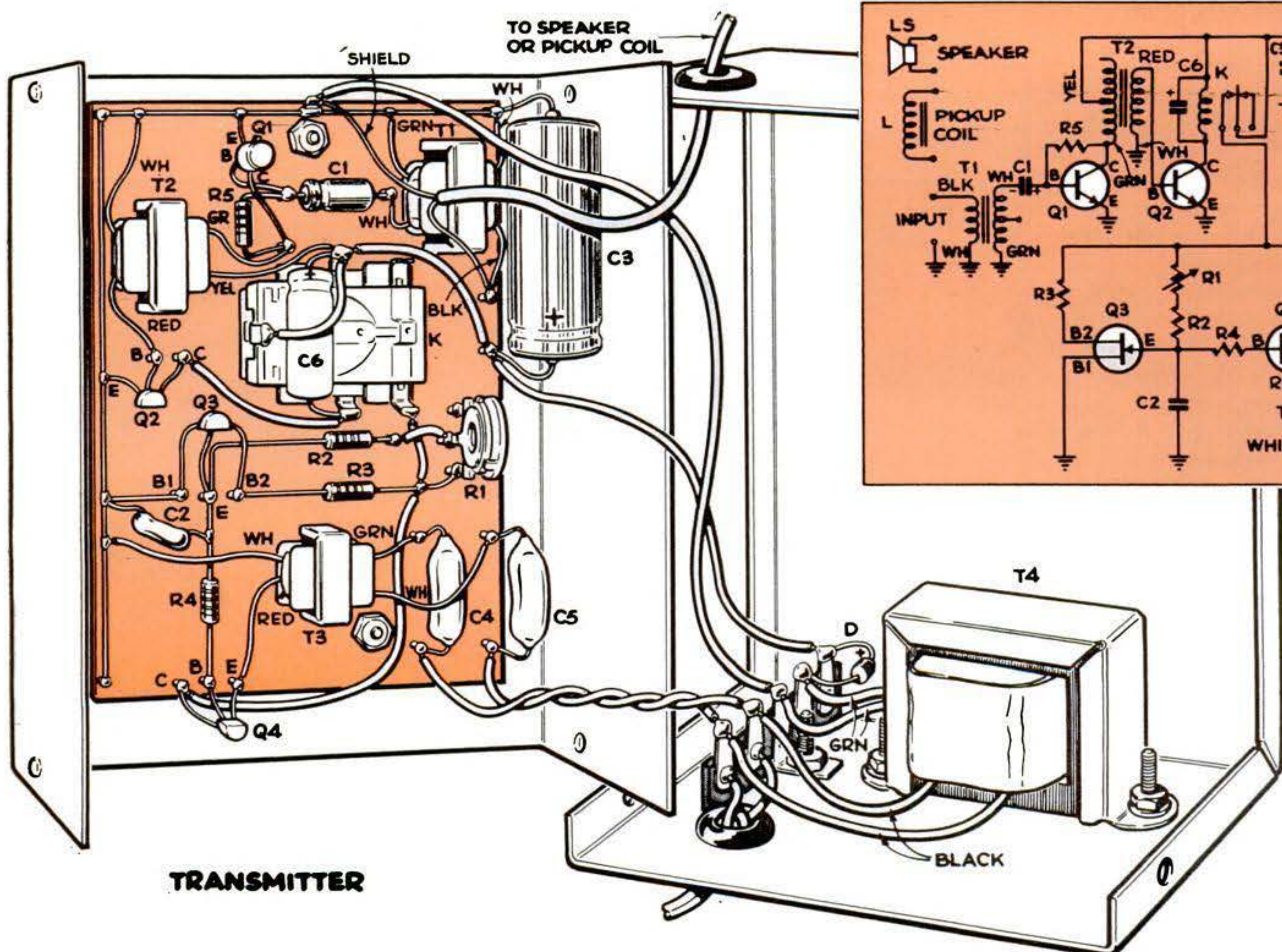
Now wind the *secondary* coil over

TRANSMITTER PARTS LIST

C1—10-mfd, 15v electrolytic capacitor
C2—300-mmfd dipped mica capacitor
C3—1,000-mfd, 15v electrolytic capacitor
C4, C5—0.1-mfd, 200v capacitor
C6—50-mfd, 25v electrolytic capacitor
R1—50,000-ohm trimmer potentiometer
R2—10,000-ohm, 1/2w carbon resistor
R3—330-ohm, 1/2w carbon resistor
R4—820,000-ohm, 1/2w carbon resistor

R5—220,000-ohm, 1/2w carbon resistor
D—silicon rectifier 1N2070
Q1—transistor (RCA SK3020)
Q2, Q4—Darlington transistor (Motorola HEP S9100)
Q3—unijunction transistor (Motorola HEP 310)
T1, T3—miniature output transformer; 500-ohm CT to 3.2 ohms (Radio Shack 273-1379 or equal)

T2—miniature driver transformer; 2,000-ohm CT to 10,000 ohms (Radio Shack 273-1378)
T4—6.3v @ 0.6A filament transformer
K—miniature relay (Calectro D1-965)
LS—miniature loudspeaker (4- or 8-ohm)
L—telephone pickup coil (Radio Shack 44-533 or equal)
Misc.—line cord; al. minibox; perf. phenolic board; push-in terms.; twin-conductor cable



the primary. Again, try to build up a uniform layer of turns.

Finally, wrap the secondary coil with plastic tape.

Cement the three transformers in place on the chassis board with epoxy cement.

Mount K on a small piece of perforated chassis board, and cement the board into a 1½" hole cut in the top of the minibox: This is the buzzer's sounding board.

You're now ready to set up.

Alignment and use. Start by setting the receiver potentiometer R5 at maximum sensitivity setting (full clockwise, as viewed from the back). This is the receiver's gain control. Leave this control at the maximum setting at all times—unless you find it difficult to tune the transmitters so that they activate only one light at a time. In such a case, reduce R5's setting slightly until the system works properly.

WARNING. When you adjust the

three transmitters, their cases will be open and their power cords plugged into wall outlets. Be careful!

Close the receiver case, and plug its line cord into a wall outlet.

Take each transmitter in turn, and connect a *temporary* lead between points A and B (across the relay contacts). This simulates the sensing of a sound or buzz, and turns on the transmitter.

Next, carefully adjust R1—working very slowly—until one of the receiver's three pilot lamps lights *fully*. The buzzer will sound even though the lamp is not fully lit.

Experiment with R1's setting until you find the strongest position.

Adjust the three transmitters so each lights a specific lamp, and label corresponding transmitters and pilot lights: "1", "2", and "3".

Unplug the transmitters, disconnect the temporary connecting leads, and close the cases.

Note: In most residential wiring schemes a single incoming 220-volt AC line from the power pole is split into two 120-volt legs at the fuse or breaker box.

If you discover that your alert system will communicate between some outlets in your house, but not between others, this means that the transmitted signal will not jump from one 120-volt leg to the other.

The cure is simple: Have your electrician wire a 0.1-microfarad, 600-volt, plastic or paper capacitor between the hot wires of each leg. This will provide a path for the high-frequency signals.

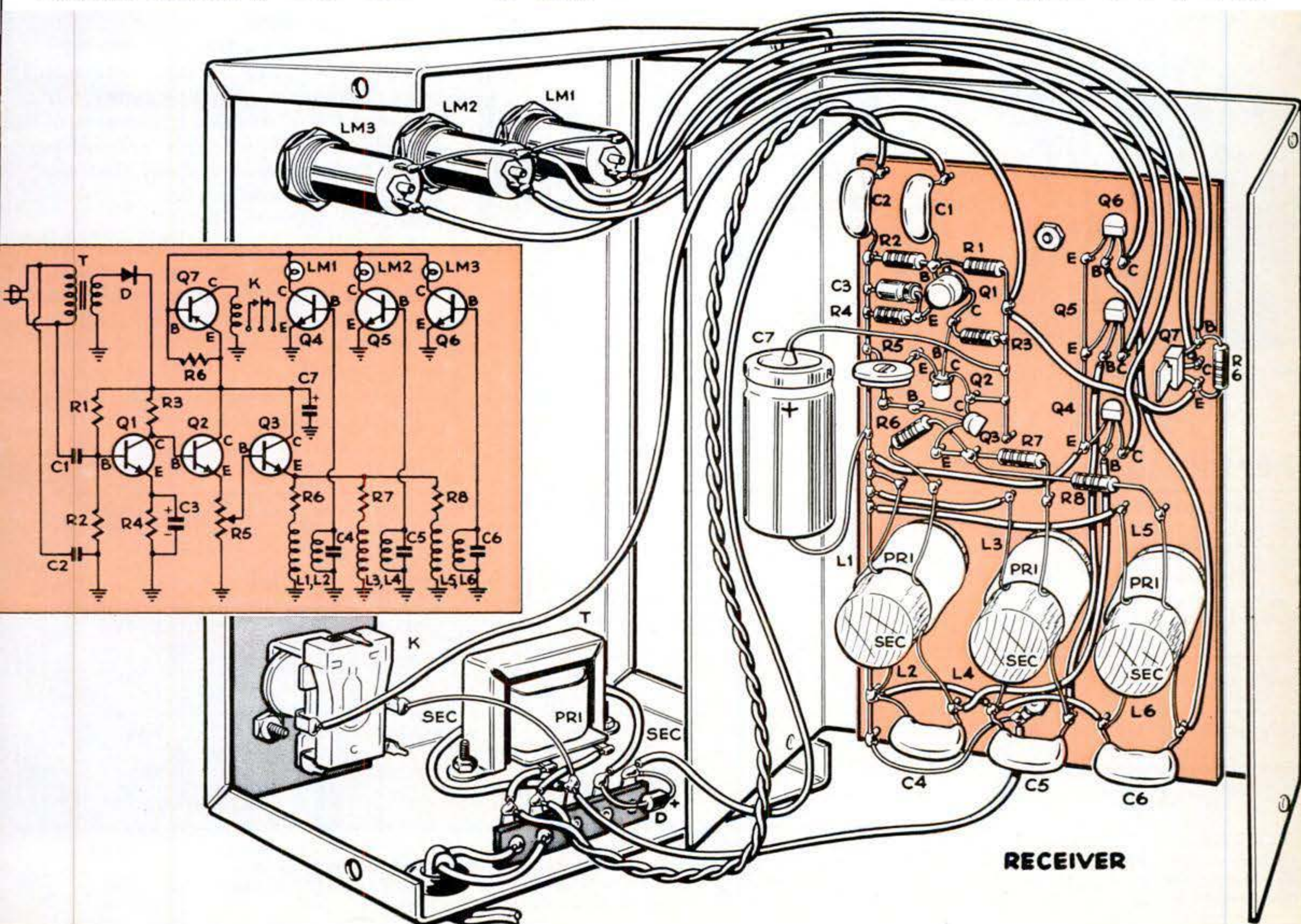
The patio alert will make your leisure time more leisurely. With the sensors in place, you need only plug in the receiver each time there's a family outing in the yard. And, construction time will be far less than time spent checking the house at every noise all summer.

RECEIVER PARTS LIST

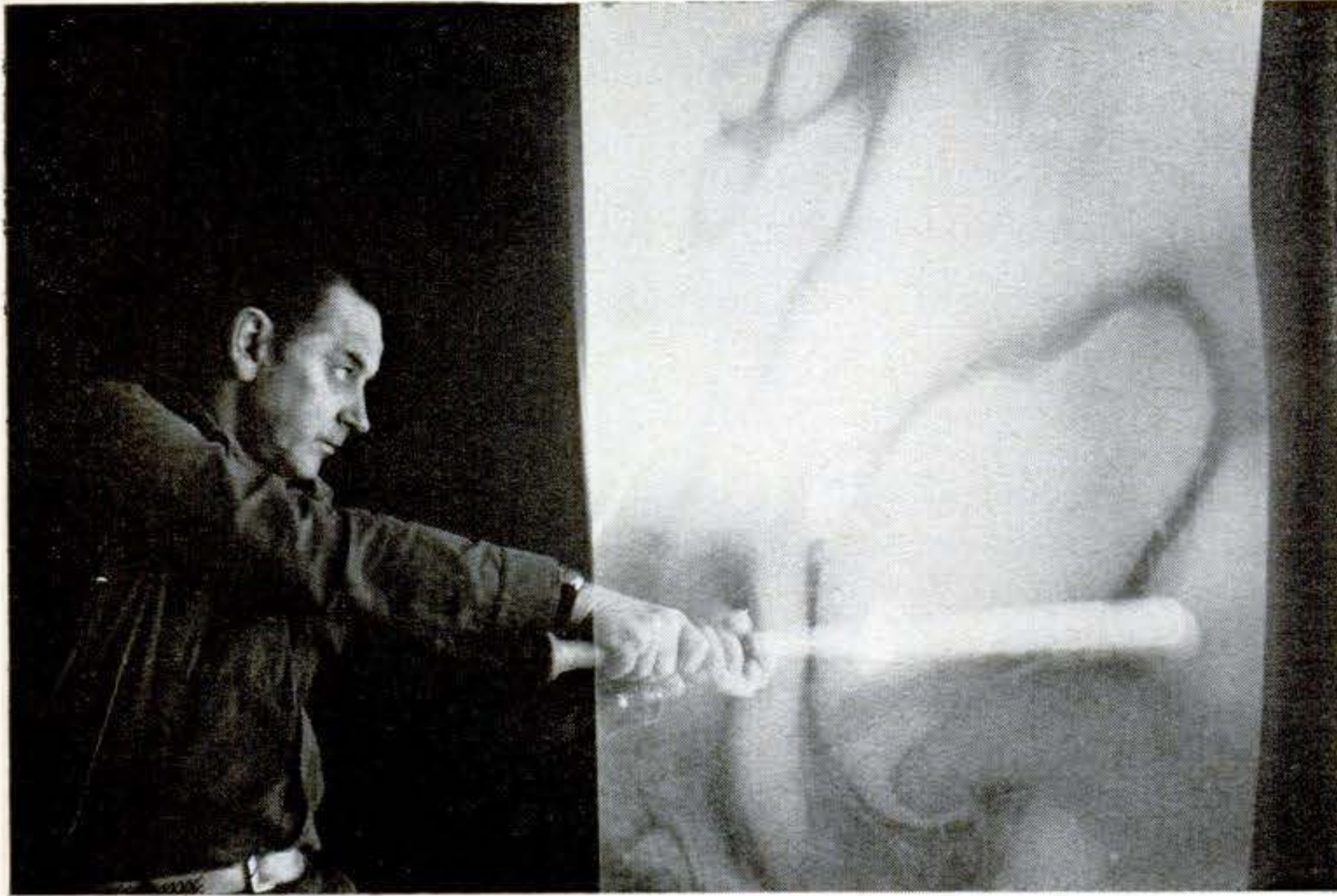
C1,C2,C4,C5—0.01-mfd, 200v capacitors
C3—10-mfd, 10v electrolytic capacitor
C6—0.0068-mfd, 200v capacitor
C7—1,000-mfd, 25v electrolytic capacitor
R1—1,200-ohm, ½w carbon resistor
R2,R6,R7,R8—1,000-ohm, ½w carbon resistor

R3,R4,R6—4,700-ohm, ½w carbon resistor
R5—10,000-ohm trimmer potentiometer
D—silicon diode 1N2070 (or similar)
Q1,Q2—transistor (RCA SK3020)
Q3,Q4,Q5,Q6—Darlington transistor (Motorola HEP S9100)

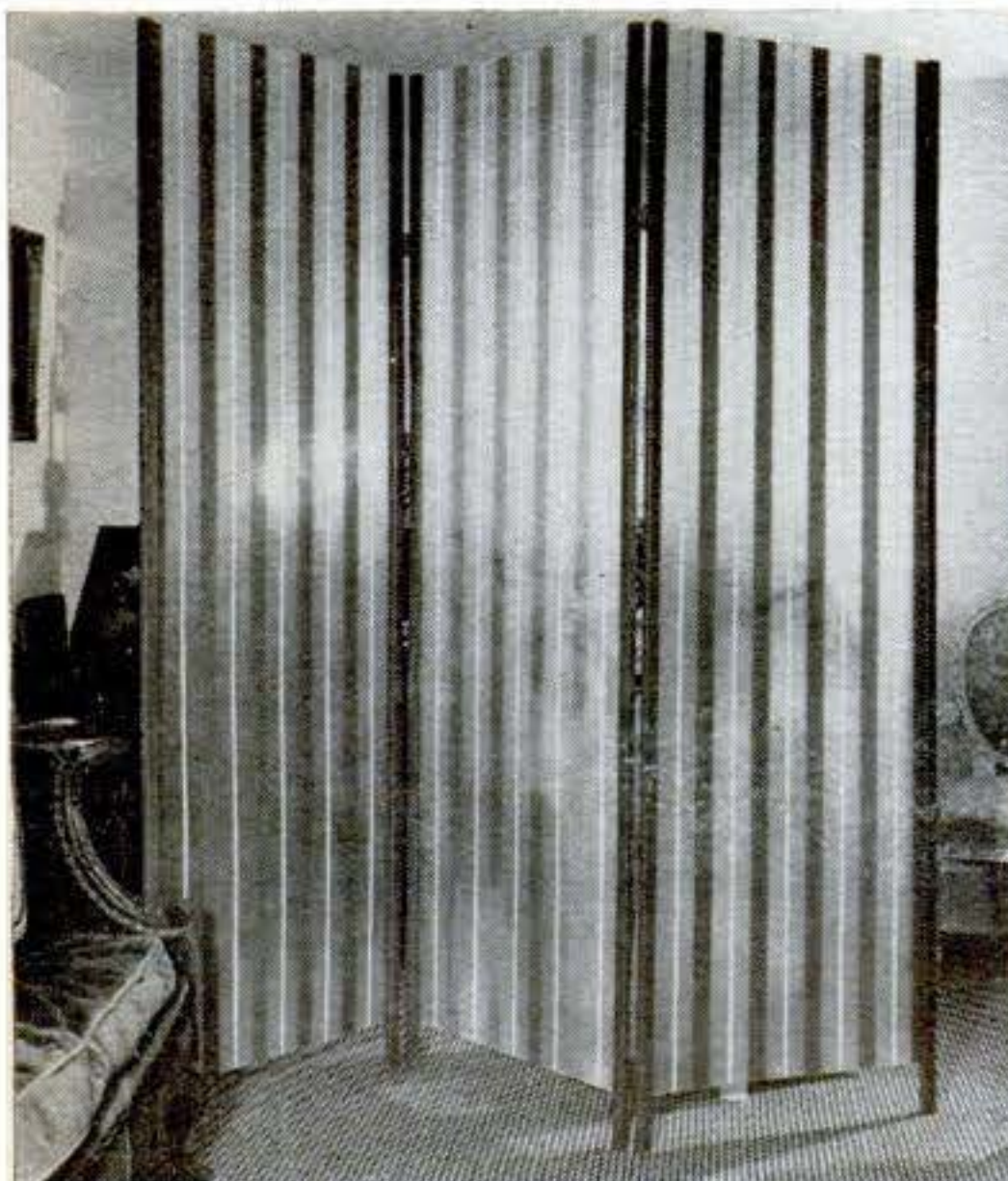
Q7—power transistor (GE-29)
T—12.6v @ 300 ma filament transformer
K—miniature relay (Calectro D1-965)
LM1,2,3—panel-mount lamp holders; #47 lamps
Misc.—coil wire; al. minibox; ¾" dowel; perf. circuit board; push-in terminals; line cord



Those Tough New Plastics



Powerful wallop with baseball bat won't shatter this $\frac{1}{8}$ -inch Filon vinyl sheet.



Colorful folding screen made with Filon striped sheet functionally divides room space while letting light filter through.



Shatterproof plastic sheeting for screen at left can be handled like wood. Slide sheets into frame and secure with brads.

Easy-to-work scratchless plastics install quickly and make your home safer

By JACKSON HAND

Each year about 100,000 persons in the U.S. are injured—or worse—when large pieces of glass around the house break and become virtual swords or guillotines. Recently a New Jersey woman, whose son was killed by broken glass, wrote to the governor of the state insisting “there ought to be a law.”

There are laws now, in about half the states, that say any piece of glazing in a hazard-prone situation must be a “safety material.” The newest of the extra-safe materials are also the handiest to use: sheet plastics. And they’re getting safer and more durable all the time.

Here are some of the developments that have brought new excellence and acceptance to sheet-form plastics used in nonglass glazing.

- The Underwriter’s Laboratory has given a “burglarproof” rating to GE’s Lexan (a polycarbonate). In fact, most plastic-sheet glazings warrant the term. It would be so hard to break through one of them that the racket would arouse the neighborhood.

- Resistance to weathering and abrasion has been so improved that some plastics rate almost as high as glass. This has been brought about in large part by the addition of transparent “overlays” or coatings of special resins on Plexiglas, Lucite (both acrylics), and Lexan, and such pro-

Sheet Plastics: What You Should Know

Type of Plastic Sheet	Standard Sheet Size (maximum) ¹	Thickness for Glazing	Cost per Square Foot	Breakage Rating	Abrasion Rating ²	Weather Rating	Heated Bending	Colors and Patterns	ANSI Approval ³
Acrylic	4' x 6'	$\frac{1}{8}$ " to $\frac{1}{2}$ "	\$1.60 for $\frac{1}{8}$ " \$2.50 for $\frac{1}{4}$ "	Good	Good to excellent	Excellent with coating	Bending with strip heater is generally possible, except with plastic materials that are coated.	Wide selection	Yes
Polycarbonate	5' x 8'	$\frac{1}{8}$ " to $\frac{3}{8}$ "	\$2.17 for $\frac{1}{8}$ " \$3.40 for $\frac{1}{4}$ "	Excellent	Good to excellent	Excellent with coating		Clear, bronze gray	Yes
Vinyl	3' x 6'	.06" and .08"	\$.80 for .06" \$1 for .08"	Good	Good	Excellent with Tedlar		Wide selection	Yes
Polystyrene	3' x 6'	$\frac{1}{10}$ " and $\frac{1}{8}$ "	\$.40 for $\frac{1}{10}$ " \$.50 for $\frac{1}{8}$ "	Good	Good	May yellow and turn brittle		Wide selection	Yes
Fiberglass	2' x 6'	$\frac{3}{4}$ "	\$8 per panel	Excellent	Good	Good		Variety of colors and stripes	Yes

1—Since these materials are cast, there are wide ranges in sizes on special order; many, however, exceed feasibility for glazing.

2—Abrasion rating is poor for untreated sheet materials, although coated versions resist abrasion equivalent to up to “20 years of scrubbing.”

3—American National Standards Institute approves the materials for glazing purposes up to certain sizes.

That Replace Glass

protective films as Tedlar on Filon plastic sheets.

● **Recovery from damage** is another new and unique factor. Plexiglas 70, for example, "heals" after it is struck with a sharp object. There may be stress marks for a while, but they gradually disappear.

Ease of handling. As important as safety and durability is the ease with which plastics for glazing can be handled. They are light in weight, unlikely to break in handling, and simple to work with ordinary hand tools. Some have unique qualities, such as bendability when heated.

Framing is important. Suppose you need to replace a storm-door insert. Ordinarily, it takes days to get the glass cut and enclosed within its frame by a professional. Using one of the plastic sheets, however, you merely cut it to size and insert it in the door *without* bothering to frame it. (And if you're thinking in terms of safety glass—as you should for a storm door—the professional job will take even longer, since tempered glass is made to size at the factory and cannot be cut by the typical glass dealer.)

Sizes and thicknesses. The dimensions of sheet-form plastics are given in the accompanying table. In selecting one, you relate area to thickness. The American National Standards Institute recommends a thickness of 1/10 inch for typical small windows. The recommendation of acrylic sheet manufacturers is for 1/8 inch thickness up to three by four feet; 3/16 is okay up to five by six feet; 1/4 goes up to five by eight feet; 5/16 is considered okay up to about six by eight feet. (Du Pont's acrylic is made in sizes up to eight by 12 feet for use as stock.)

Building codes are not yet universal

in insistence upon safety glazing materials, even for such obviously hazardous situations as sliding glass doors and other large-area entrance features. But the U.S. Public Health Service has appealed nationally for safety regulations, and it's likely that safety glazing will soon be required for hazardous situations—construction, residential, commercial, industrial—in all states.

What goes where? As the accompanying table indicates, there are various degrees of breakability (burglarproofness), decorativeness, and economy available in nonglass glazing materials. Make your selections on the following rough recommendations:

● For maximum security against breaking and entering, think of Lexan or an acrylic material.

● For maximum abrasion and weather resistance, pick Plexiglas 70 or Lexan MR-4000 or Filon with Tedlar.

● In a situation where windows or doors would get dirty and need frequent washing—perhaps with gritty deposits—pick Plexiglas 70 or Lexan MR-4000 or vinyl with Tedlar.

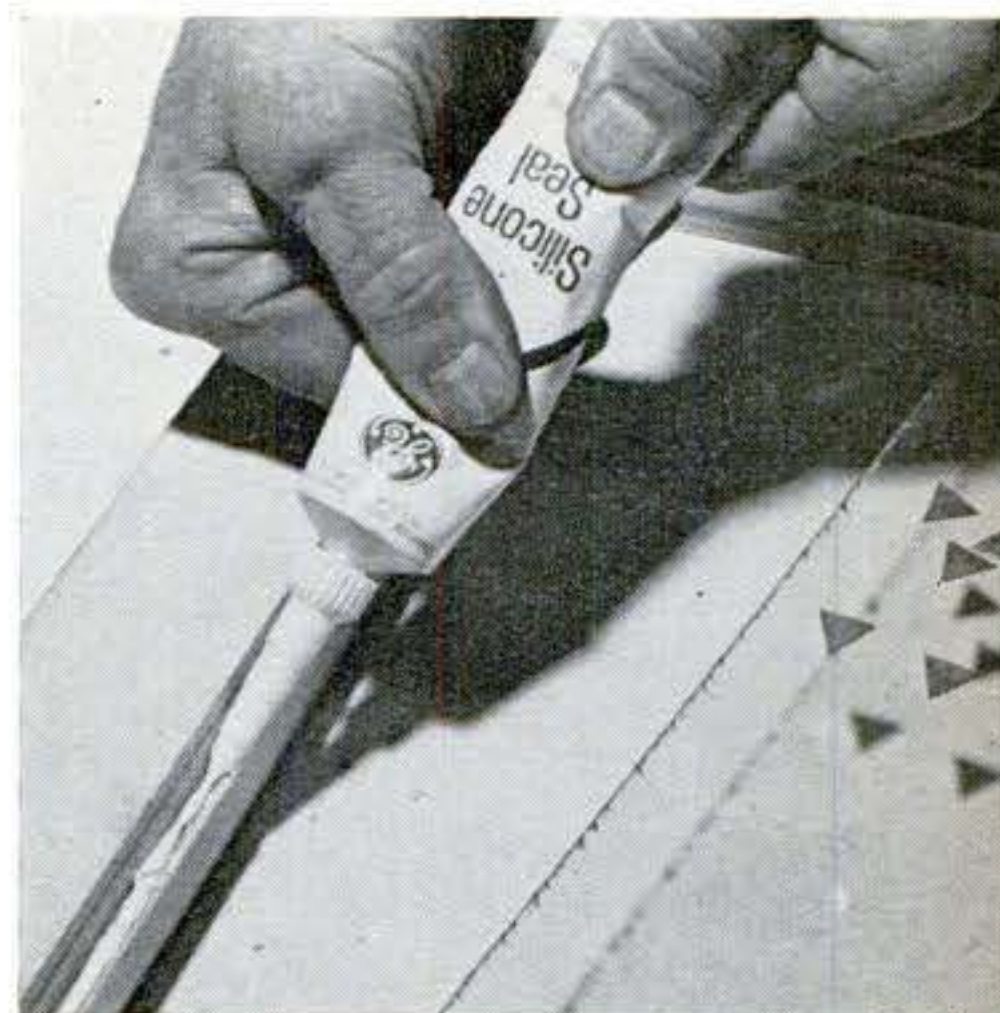
● Flanking a playground area or other situation where physical abuse is likely, choose Plexiglas or Lexan.

● For any big-glass area such as sliding doors, shower enclosures, etc., use Plexiglas or Filon in the heavier thickness.

● For medium-abuse situations, such as basement windows or other small-pane areas, get Filon vinyl.

● Where decoration, color, or pattern is important, K-Lux or Plexiglas or Filon fiberglass are best.

● For the greatest protection for the least money, buy vinyl or polystyrene sheet plastic.



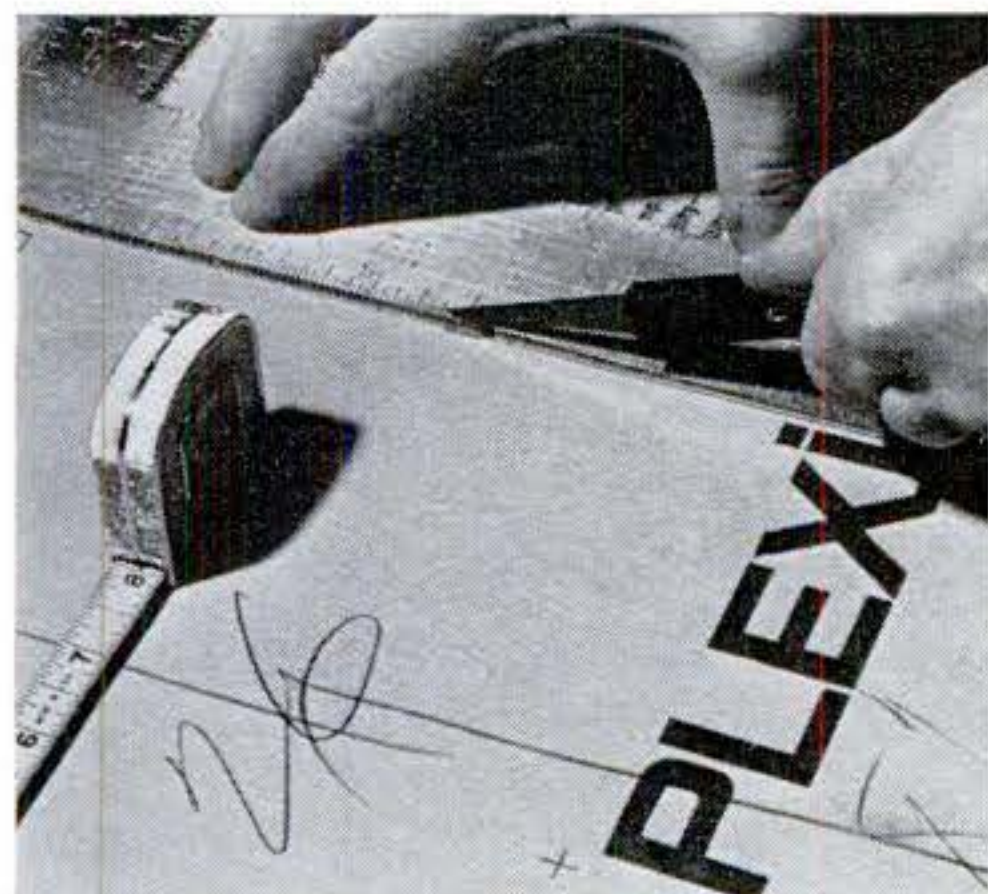
When replacing broken glass with plastic, remove old putty. Use either a flexible glazing compound or a silicone sealer.



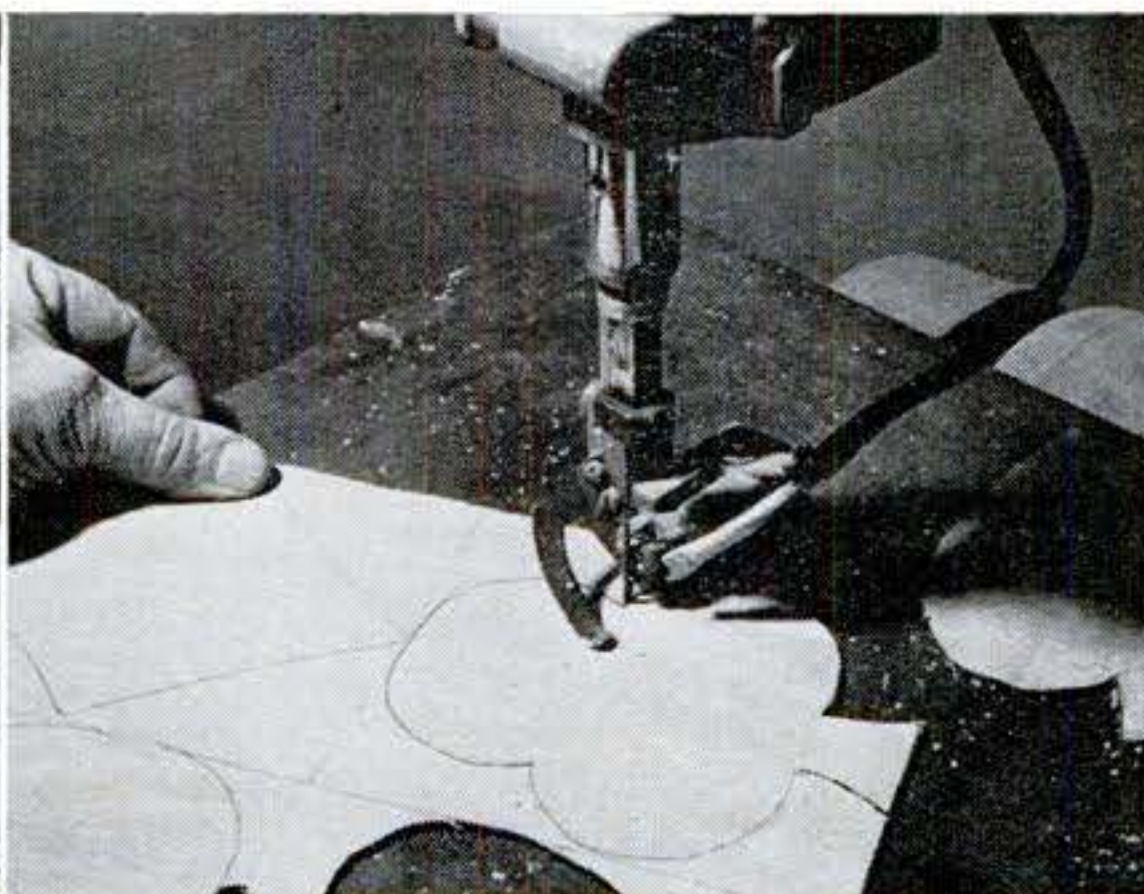
Protecting exposed wallpaper corners is one use for sheet plastics. Angle-bent, thin vinyl is screw-fastened at corners.

Working techniques. Virtually any tool you use to work with wood can be used on plastic sheets: saw, plane, jointer, rasp, drill, countersink, shaper, sander. Some of the thinner sheets,

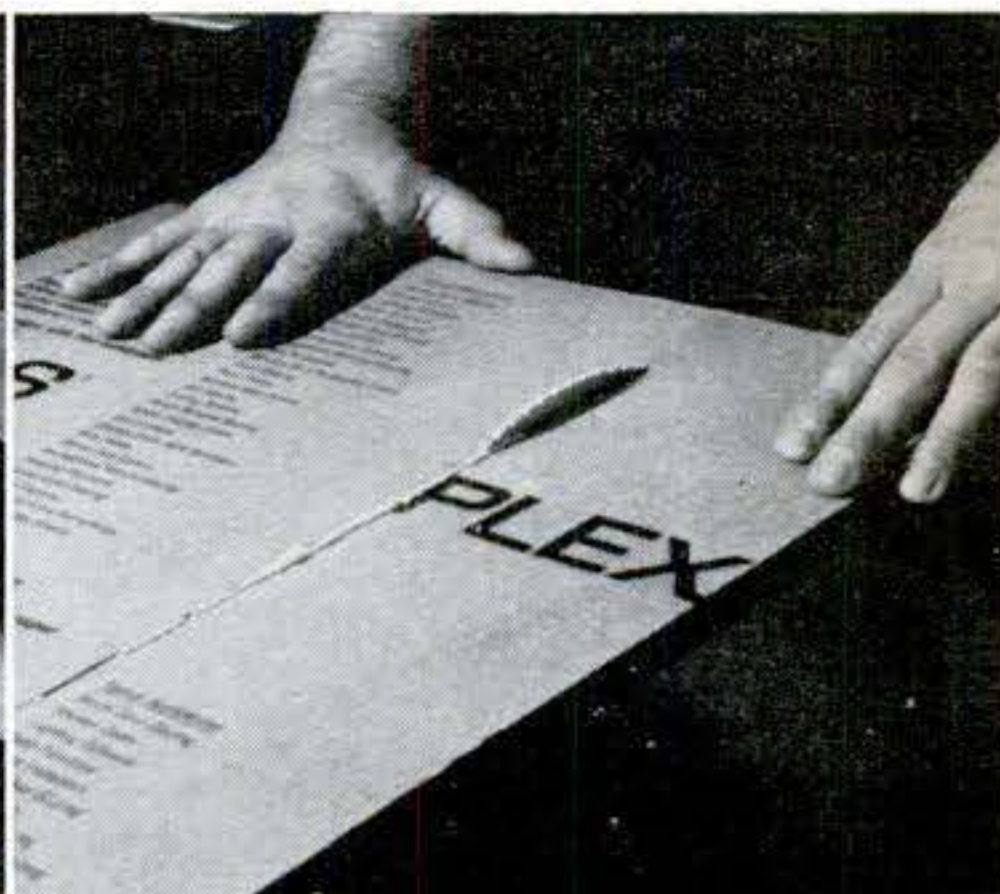
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Scratch knife, sold at sheet retailers, is easy way to cut thinner material. You just break sheet along deep-scribed line.

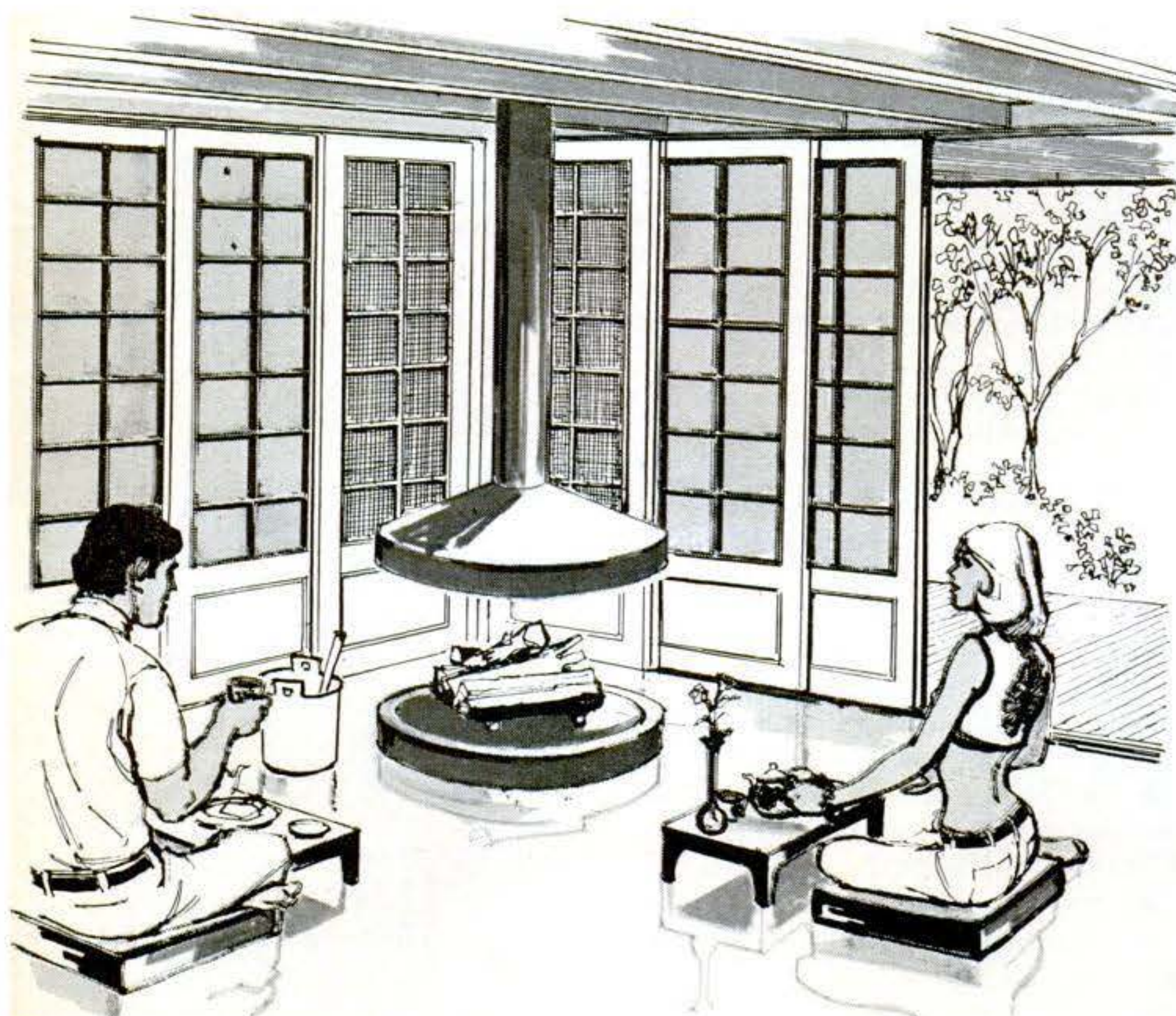


Powered jig, saber, or band saw makes curved cuts. Edges of these card-table coasters are sanded after paper is removed.



Set circular-saw blades just above sheet to prevent chipping. Use crosscut blade suitable for finish cuts on plywoods, veneers.

Building the Backyard



Inside corner stores shoji doors behind outer plywood panels. Here, screens are in

stored position, Filon panels are shut at end (left), partly shut at side (right).

We introduced you to the Japanese-style outdoor family room on the opening pages of this special section. Construction isn't difficult. With one or two steady helpers, you should be able to erect a structure of the dimensions shown here in time to enjoy it this summer.

Since it's not a habitable building, you should have no trouble with local codes, but it's best to check before you begin. Some codes require a permit for any detached structure. And you'll doubtless be running electricity to it for party lighting, record player, and cooking accessories. You might even want a water line for a bar sink.

It can take it. We've framed the tea-house with sturdy timbers so it'll stand up to rugged party use. The 8-by-8 corner posts may seem excessive until you stop to think that only one closed wall supports the roof. Three sides are open, except for the solid corner panels. These are $\frac{3}{4}$ " exterior plywood, painted off-white and framed with dark-stained strips of 1-by-3 pine.

Thorough nailing of these plywood corners gives the structure rigidity. Within these corners, the door panels store, butted against the posts.

Ideally, the framing should be redwood, given a deep stain. As an alter-

native, use any construction-grade softwood—preferably one that's been preservative-treated. In this design, the posts aren't set into concrete, but are seated in metal column bases which are, in turn, anchored to the below-grade concrete footings. If you

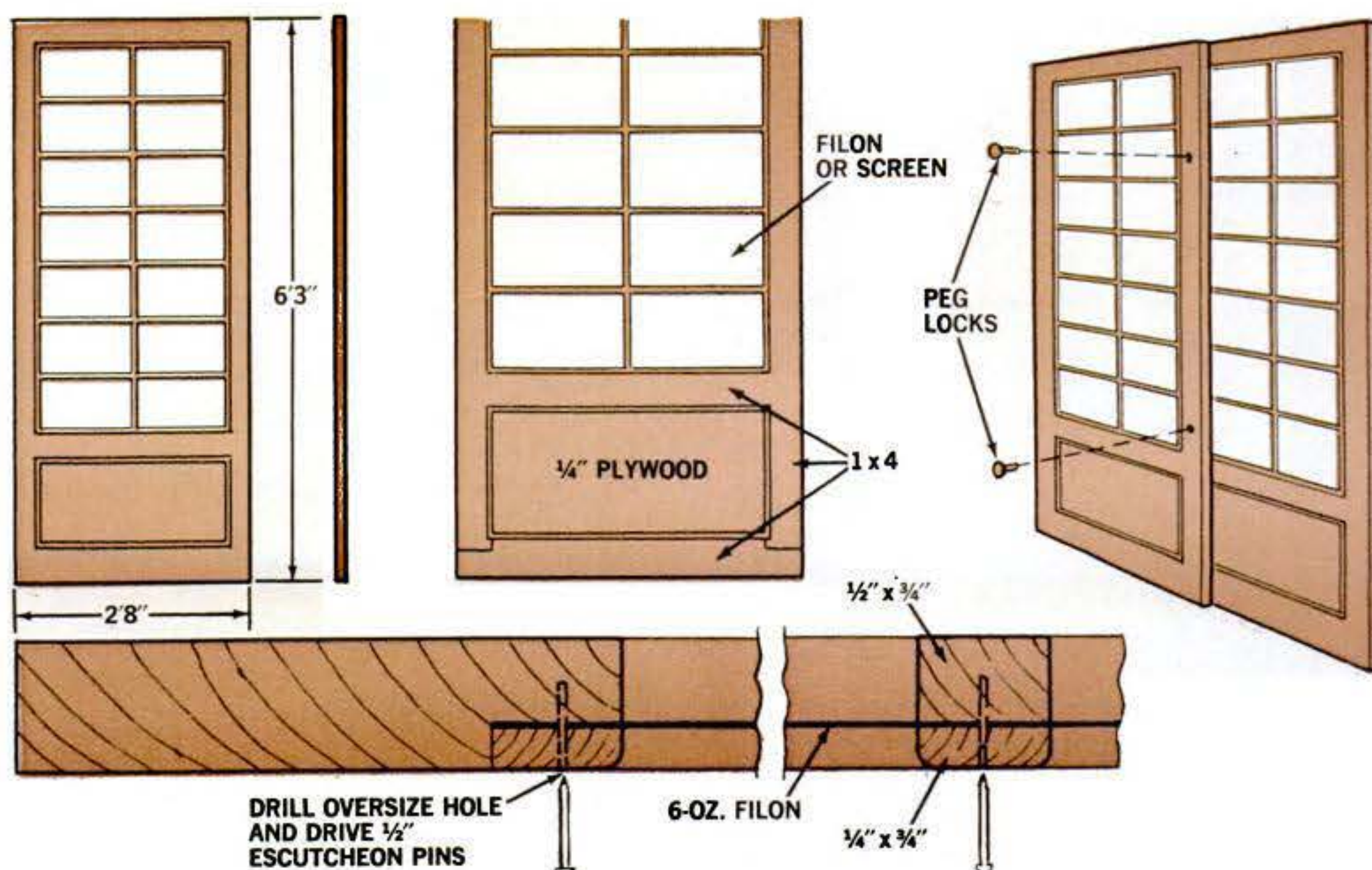
wish to embed the posts for greater rigidity and easier construction, pressure-treated lumber is essential.

Otherwise, carefully lay out your concrete footings (19 are required in sketch at right) and pour them with level tops, embedding anchor bolts at appropriate attachment points. Erect the posts first, holding them plumb with staked braces.

Up she goes. Next, assemble the roof-support beams atop the posts, anchoring them with metal angles. If your lumberyard can't supply 2-by-10s in 26' lengths, you can, of course, splice these doubled beams from shorter boards.

Install the deck framing and add the short 2-by-4s on edge. Note that the longer 2-by-4s are spaced 16" o.c. within the area of the interior floor. On the top edges of these joists, run a bead of construction adhesive, and nail on $\frac{3}{4}$ " plywood. You'll need six sheets—preferably tongue-and-groove underlayment. (If you want a surface for dancing, top with tempered hardboard, later.)

Now you've got a sturdy platform for making the roof trusses. You'll need five, assembled one atop the other so they'll be identical. Erect them one at a time across the support beams and lock them into a grid with the four 2-by-4 let-in ties. Add the "hip" framing at each end, blocking to fill gaps as shown. For sheathing the main roof, you'll need 12 4-by-8 sheets of $\frac{1}{2}$ " Plyscord, fastened to truss as-



Door frames should be kept simple—you have 20 to make. Notch top and bottom rails to take stiles; join with dowels and

glue, after rabbeting all inner edges to take screen, Filon, or plywood. As option, pairs can be drilled for pegs after installation.

Teahouse

semblies and ties with galvanized roofing nails.

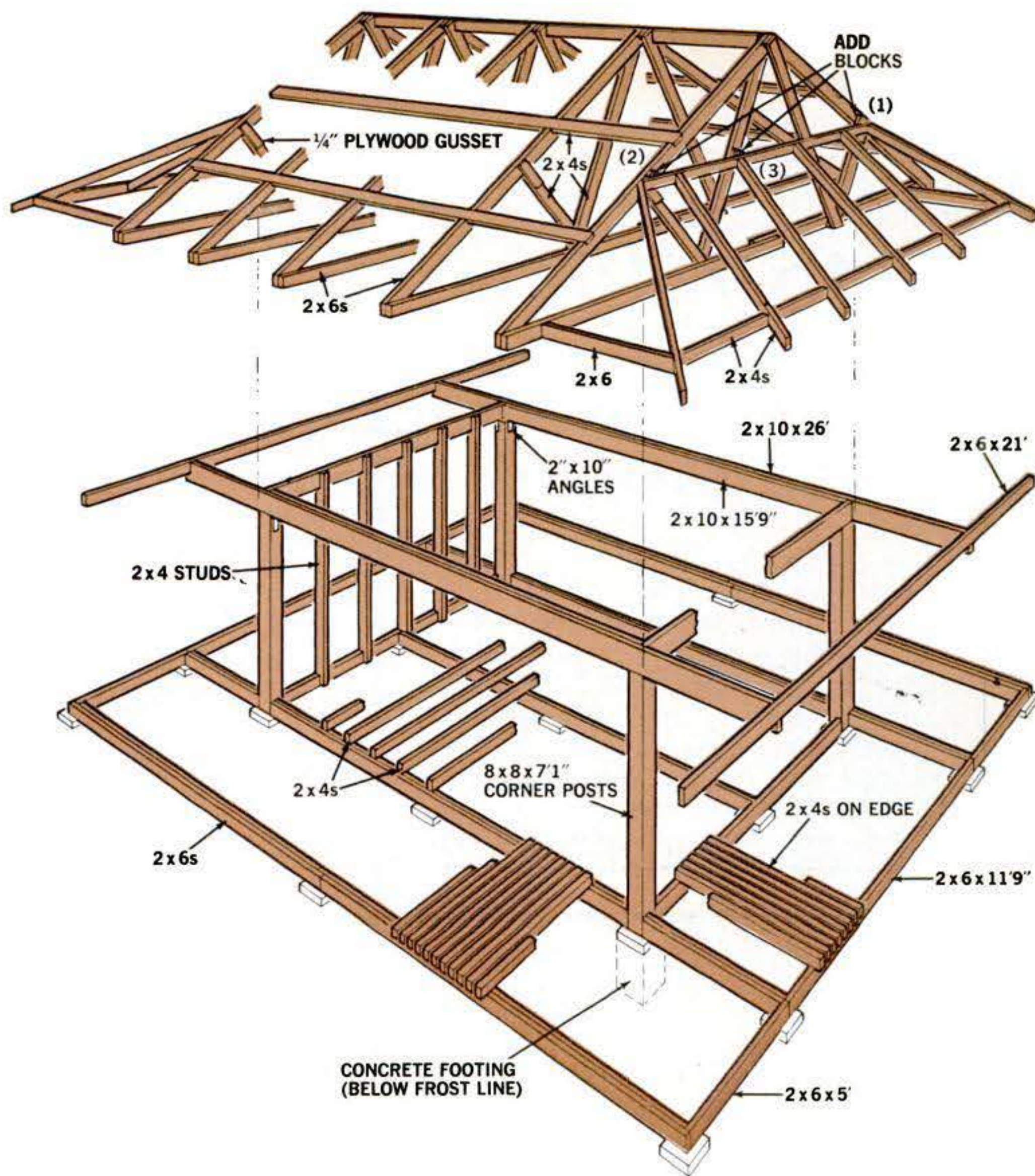
Shingle with cedar shakes or one of the new random-butt asphalt designs that simulate rustic shingles.

Door panels are framed identically for screening and Filon, but the screen is stapled in place before molding strips are nailed on. Center muntins merely butt the outer molding frame, and are fastened with exterior glue at each joint. It's easier to pre-prime and paint these strips prior to assembly. The solid panel at the bottom of each door can be $\frac{1}{4}$ " plywood or tempered hardboard.

Tracking the doors. One system is shown below. Note that the channels formed by the wood strips fastened to the bottom of the roof beam must be deep enough to permit tipping up each door panel so that the plastic strip projecting from the bottom rail can be swung over and dropped into the floor kerf. (Long sides have four kerfs.)

The plastic, moving in the kerf, tends to be self-lubricating and self-cleaning. If doors bind, remove them and apply a good wax or silicone lubricant to the bottom edges.

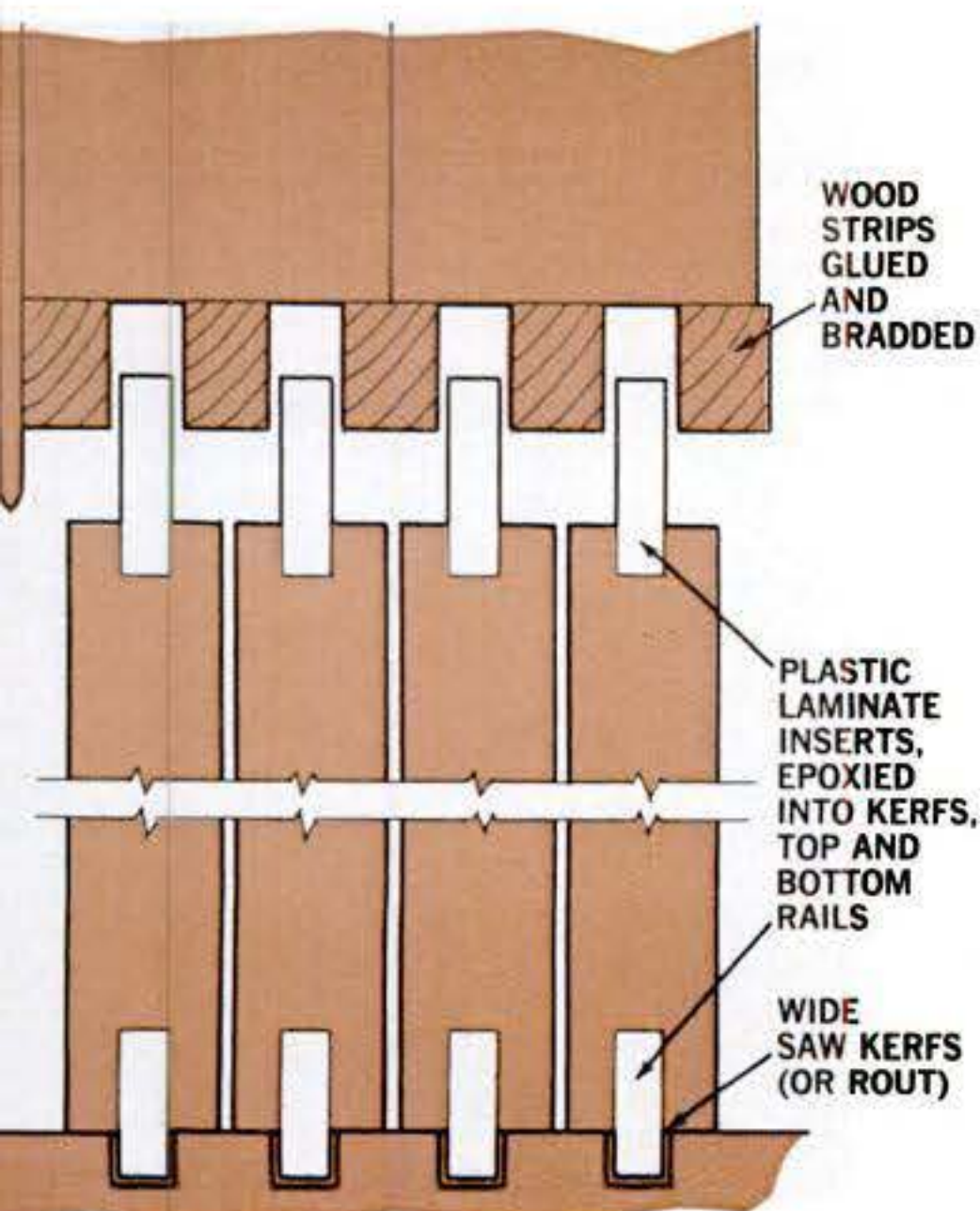
A more authentic Japanese system is use of wood strips as both tracks and spacers, top and bottom. But our heavier shoes can make short work of the floor strips, and the channels do tend to clog with debris. Neither system is much use in ice or snow, but we're assuming the structure will be a closed storage shelter during cold-



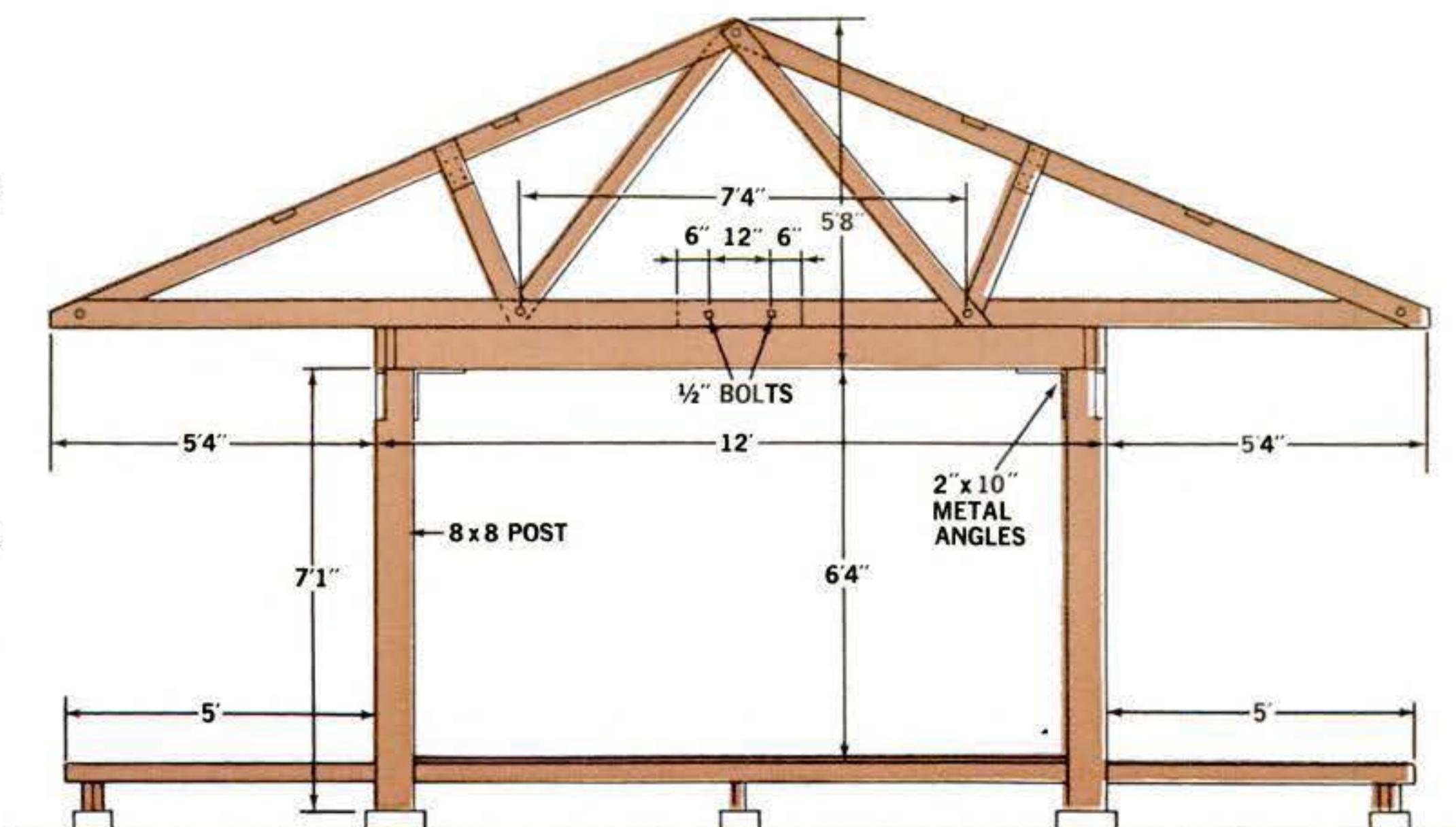
country winters, Filon doors out.

We've copied a simple, clever lock that pins the panels together. For greater security, apply a padlock to the end pair of doors after you've pegged the others from inside. **P.S.**

Want architect's plans with more details? Send \$3.95 for Plan 5543 to PS Plans Div., 355 Lexington Ave., New York, N.Y. 10017. Need an extra to file for a building permit? \$4.95 brings you two sets of plans.



Track system can be this simple: kerf top and bottom edges of door frames and cement in strips of countertop plastic.



Basic dimensions for framing (shown in pull-apart at top) give you 12'-by-16' interior space. You'll need five truss assem-

blies: 2x6 triangles with 2x4 braces. Note notches to let in four 16-ft. ties; four spacers at ridge complete truss installation.



How to Add a Bay Window to Your Home

Did we whet your appetite with those tempting photos of angle bay, bow, and box windows in our color section? You can add such a window to your home with little expense beyond the price of the ready-made unit. The chart at right gives you an idea of the range of stock sizes you can choose from.

The architectural style of your home will

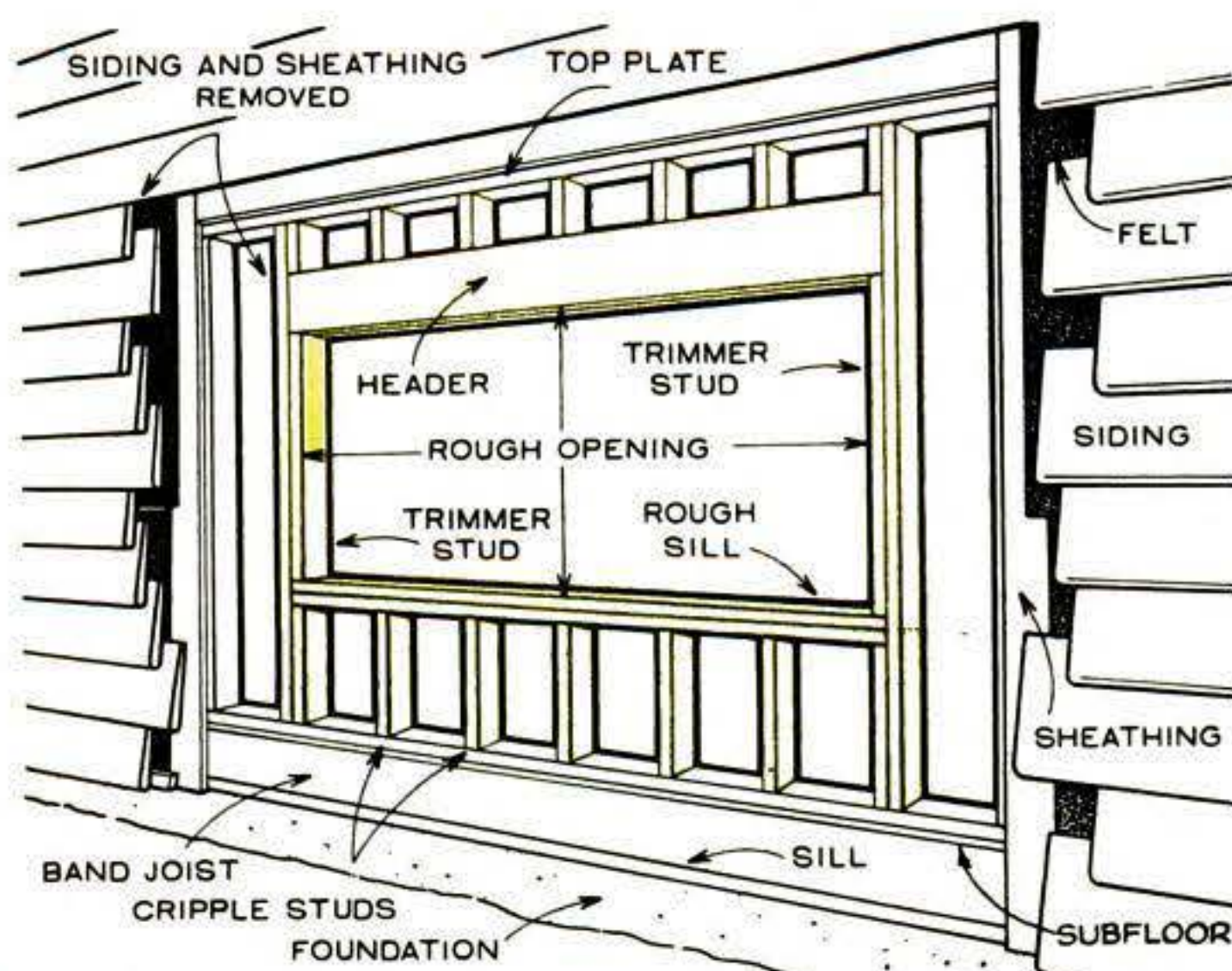
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SIZE RANGE OF READYMADES

BOW WINDOWS		
	Widths	Heights
CASEMENTS 3 to 7 units	5'10½" to 14'9½"	4'2" to 6'8½"
DOUBLE-HUNG end units, center fixed	7'9" to 11'3¾"	4'10½" to 5'0½"
AWNINGS working or fixed	5'11" to 14'0¾"	3'3½" to 6'5½"
ANGLE BAY WINDOWS		
CASEMENTS 3 units, center fixed	7'11½" to 9'2¼"	4'9¾" to 5'5¾"
DOUBLE-HUNG 3 units, center usually fixed	6'3¾" to 11'9"	3'7½" to 5'7¾"

NOTES: Dimensions are rough openings for narrowest to widest and shortest to tallest units offered in major window catalogs. (Only wood-framed units are listed.) Since there are few industry standards, no single manufacturer will offer full size range. Chart helps you plan your preference; finding exact size you decide on may require shopping around. Box windows are not listed since they are custom-assembled, usually at site, from standard wooden windows.

Tips for replacing a small window with a bay, bow, or box



The job can be done from inside or outside, depending on type of exterior and speed of installation. If remodeling is being done on the interior, too, and dust is no problem, it's easier to remove the wall-board or plaster for framing the new opening from inside. Otherwise, if the job can be done in a day or a weekend, remove siding or shingles along with the sheathing to expose the framing. Don't cut into the wall with a power saw; you might hit wiring, and insulation will fly around. Instead, remove insulation and any wiring in the area to be enlarged for the new window. Relocate the wiring.

Remove the old window and cut away studs as necessary for the new opening. Have a sheet of polyethylene handy to staple across the opening should rain threaten. If more than three studs are removed, shore up the ceiling inside the opening so second-floor or attic joists won't sag. Shore with 2-by-4s, one length held flat against the ceiling by two or three verticals wedged against the floor.

Frame the new opening to the required rough opening size specified for the win-

dow selected. Note that the trimmer studs on each side of the opening support the header, which is needed to bridge the opening and support the structural load above it. The header is made by doubling "two-by" stock. Double 2-by-6s are sufficient header size for openings up to 3', 2-by-8s should be used for openings up to 6', and 2-by-10s for openings to 12'.

Install short ("cripple") studs beneath the sill framing and between the header and the top plate of the wall framing, spacing them 16" o.c.—the same as the framing studs. Staple the insulation back around the new opening.

Once the opening is framed on the side of the wall that was removed, an accurate opening to match can be cut in the untouched wall simply by sawing along the edge of the header, the trimmer studs, and the rough sill.

If the outside of the wall was removed, cut the sheathing to fit around the opening and nail it in place. Then set in the window and level it, shimming if necessary to hold it in position. Fasten the window by driving nails through the outside

casing into the trimmer studs on each side. For extra support, nail or screw the window head to the header.

Knee brackets are recommended under a unit that's cantilevered out beyond the wall. They're not needed beneath a full height unit set on an extension of the flooring. The drip cap—usually made of vinyl or aluminum—is nailed along the top edge of the window frame.

Wood bow and bay windows installed beneath a wide second floor or roof overhang need only caulking to seal joints against weather, but a decorative roof is required above the window when it is installed with a flat wall above it. This roof, often supplied knocked down, is installed against the wall sheathing and sealed by nailing flashing over the joints, later to be covered with roofing and further protected by fitting the siding or shingles around it.

Re-install the shingles or siding, and caulk the meeting joints on all sides of the window for a tight seal. Install the stool, apron, and casing around the interior, and paint or stain as desired.

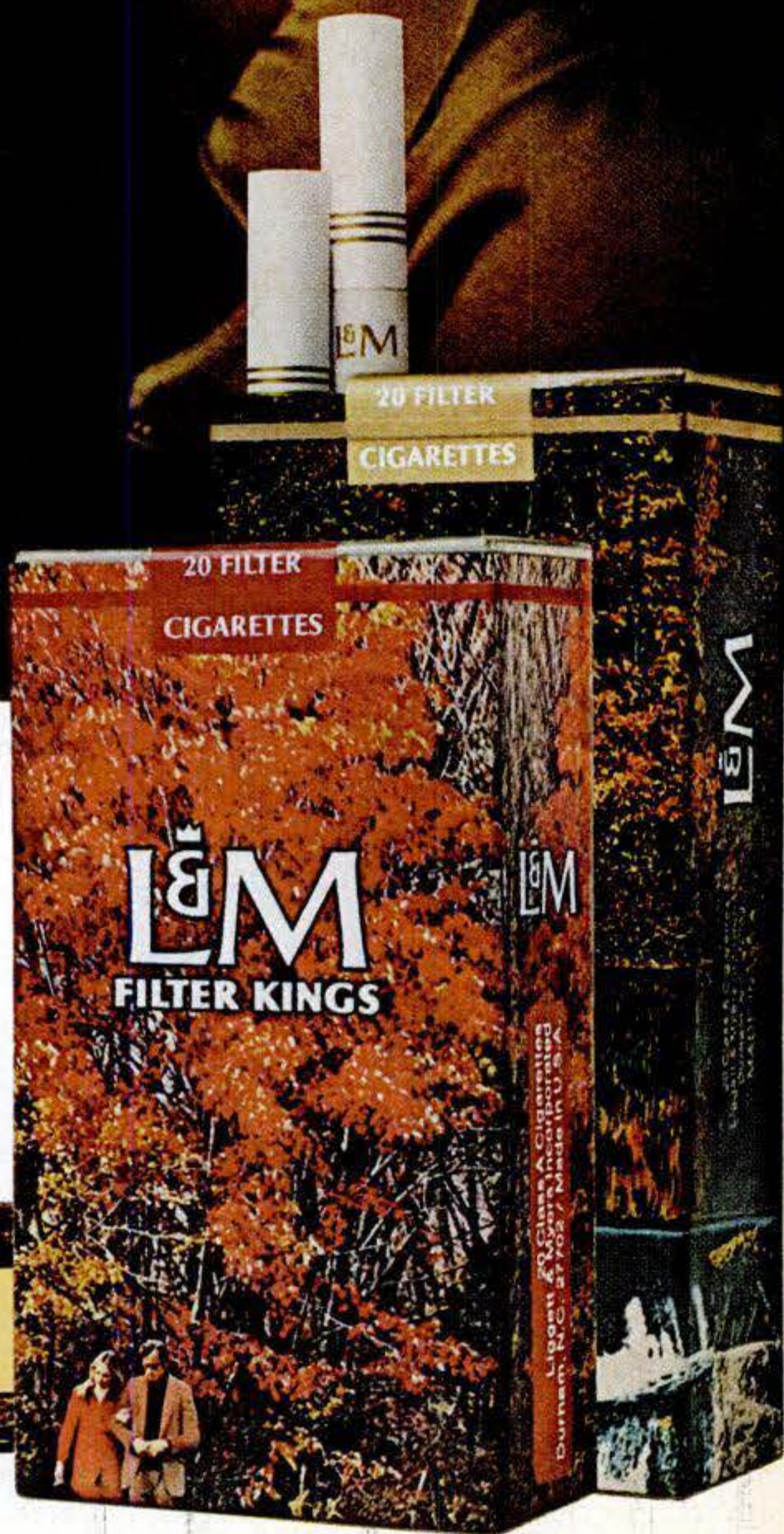


There wasn't a moment today when you could slow down.
Till now. So relax and enjoy the full-bodied flavor only
one cigarette delivers...

This...is the **L&M** moment.

RICH, RICH L&M

Warning: The Surgeon General Has
Determined That Cigarette Smoking
Is Dangerous to Your Health.



Kings and Super Kings: 19 mg. "tar," 1.3 mg. nicotine av. per cigarette, FTC Report (Aug. '71).

How to Add a Bay Window to Your Home

[Continued]

influence your choice—as will the amount of space you wish to add, and the type of view improvement from inside that you want. If you need only a little elbow room with no side views, go the box route and customize the framing to your house. The box usually protrudes 6" to 12". You can create a deeper bay by using narrow sash at the sides, as in our color photo.

A new outlook. If the window that you're replacing restricts your view to a narrow "straight-out" path, you can literally broaden your horizon with an angle bay. Those side windows—commonly set at 30 or 45 degrees—let you look up and down the street. The center sash is often fixed, but it needn't be—order a matching double-hung window of a wider size, or a series of casements.

Want a floor-to-ceiling extension? Bows are best, here. The wider ones can enlarge your floor area by as much as 15 square feet.

Modern wood windows are carefully engineered; buy only the product of a reputable manufacturer. Since you're enlarging the wall's window area, it's best to go to double-pane insulating glass. Fitting a bay window with storm sash is a problem

to be avoided, and use of insulating glass guards against the "discomfort zone" once common to large windows during cold weather. Properly installed, a bay window shouldn't overtax your present heating system.

All the stock units shown here and in the color section are framed in ponderosa pine, since the insulating qualities of wood are far superior to those of metal sash and will spare you condensation drainage and consequent winter freeze-up. For durability, ponderosa-pine windows are preservative-treated to provide water repellency and protection against rot and termites. If you hate to paint, some of the more expensive units can be ordered with tough vinyl cladding on exterior wood surfaces. This never needs painting. All quality wooden windows are weatherstripped at the factory.

Think about screens. Find out if fitted ones are available if they're not included in the purchase price. So as not to interfere with operation, screens fit *inside* casement and awning units and outside double-hungs or sliders.

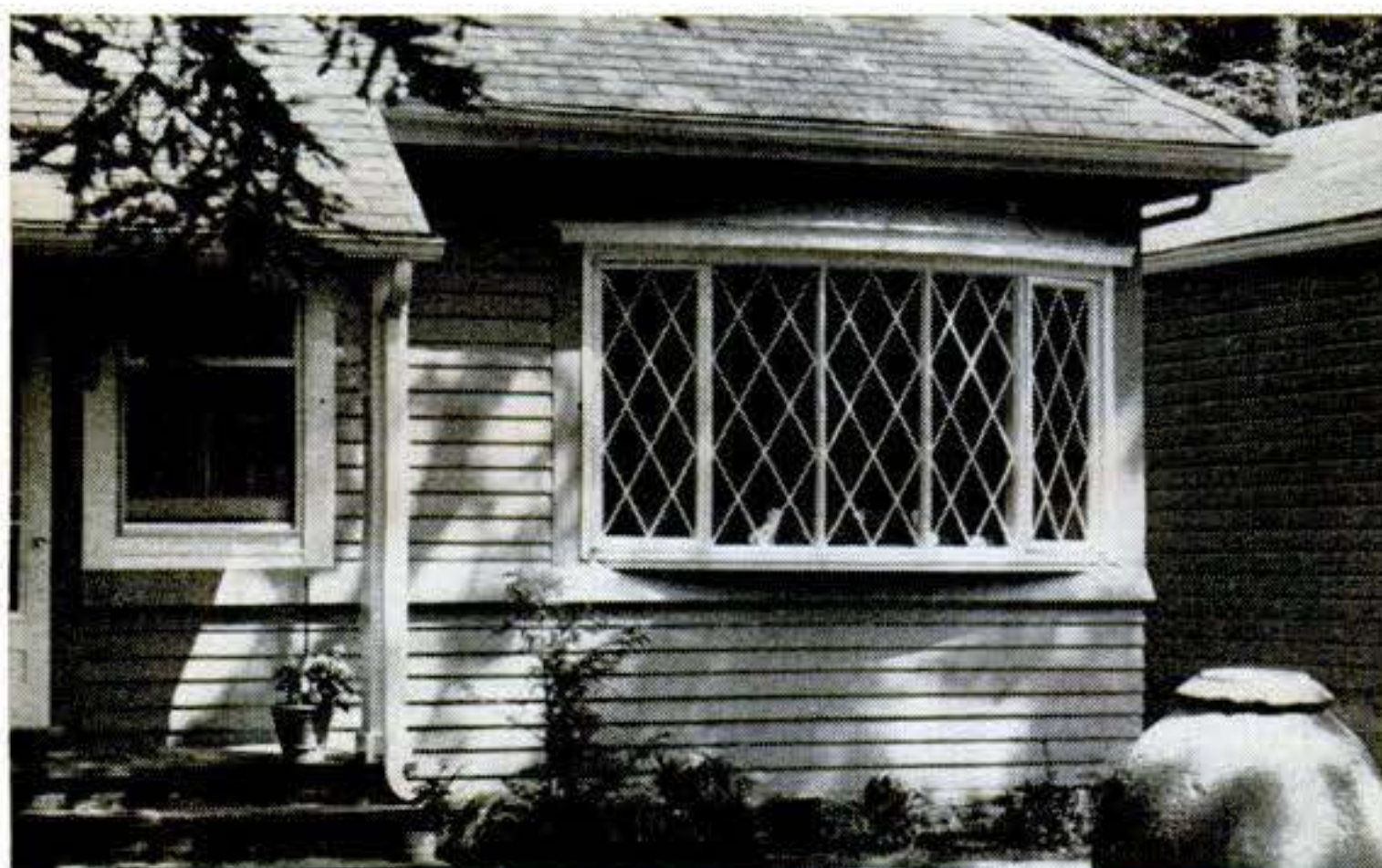
Screens are important because you're likely to find yourself opening

your new window much more than you did the old one. The protrusion of a bay makes for more effective ventilation—those side windows seem to capture every passing breeze. You're likely to find your air-conditioning bills are lower this summer.

But even if you keep the windows tightly sealed, a bay will add to summer enjoyment. In fact, air conditioning makes a bay all the more valuable. One of the ironies of modern cooling systems is that they trap us indoors. We labor for hours on our lawns and gardens, then hide behind four dark walls where we scarcely see them. A bay window can give you the best of both worlds.

How do you order? Once you have chosen the type and rough overall size you want, check local lumberyards and building-supply dealers. It's not likely they'll have such a unit in stock, but they'll show you floor samples and manufacturers' catalogs from which they'll order for you.

If you want to know who makes a specific unit shown in a photo, write Ponderosa Pine Woodwork, SR&A 355 Lexington Ave., New York, N.Y. 10017. Your letter will be forwarded to the proper manufacturer. **PS**



Casement bow (only end units are working) has snap-out diamond grilles. Insufficient eave projection required separate roof.



Box corner—with fixed sash, as here, or double-hung—pushes out both walls to create special-purpose area such as breakfast nook.

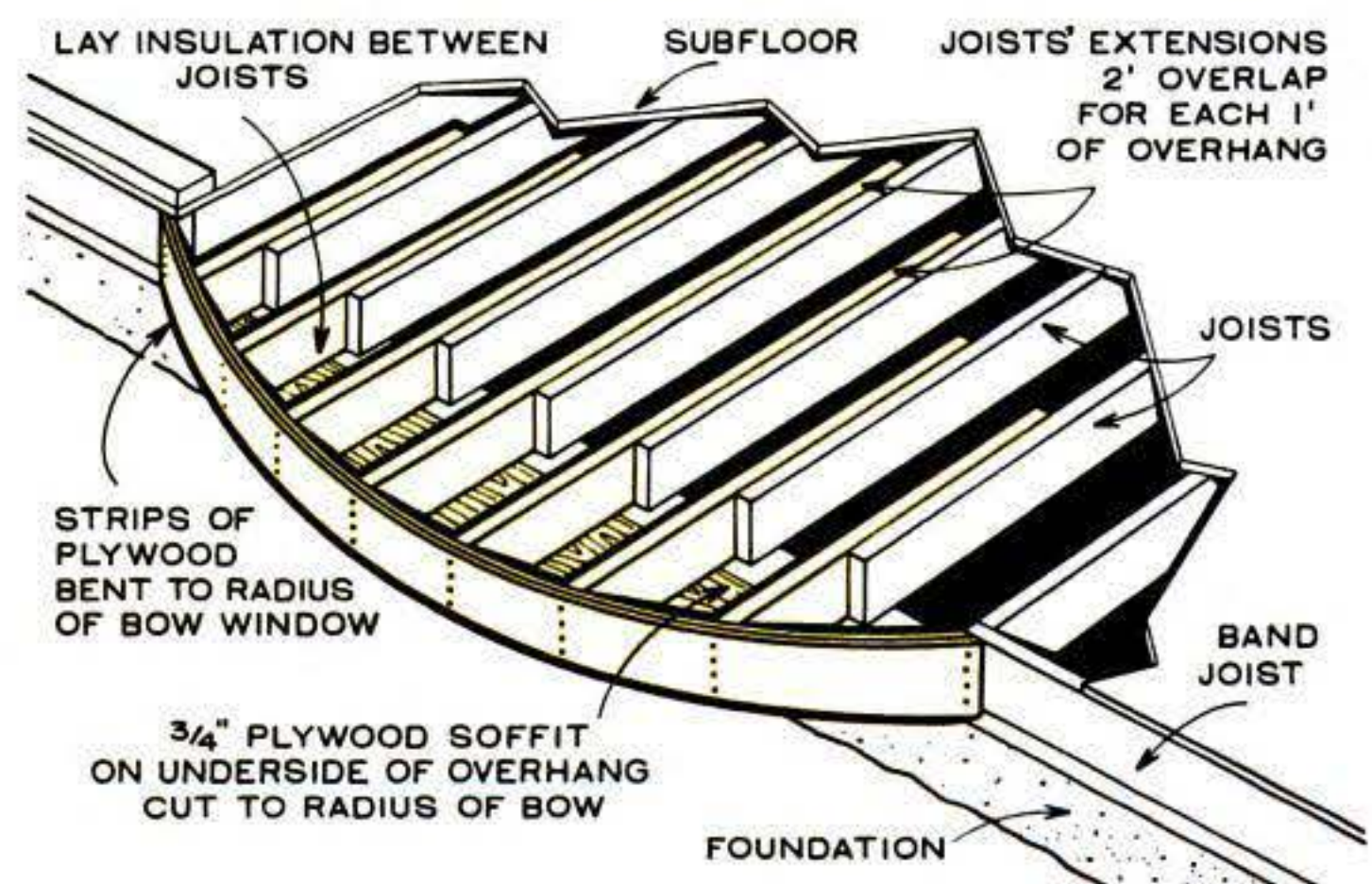
How to extend flooring for full-length box windows

Remove the siding or shingles, sheathing, and insulation in the area to be enlarged for the new window. Cut the existing band or floor header directly under the new opening and slide new joist extensions in under the existing flooring (cut back in drawing for clarity). Nail these extensions to the existing joists. A good rule of thumb is to provide two feet of joist extension inside the building (lapping existing joists) for each foot of overhang.

Swing an arc equal to the radius of the new bow window and cut the joist extensions on this arc. Close in the bottom of the overhang with $\frac{3}{4}$ " plywood cut to the radius of the new window and nail strips of thinner plywood over the joist ends to form a $1\frac{1}{2}$ " curved band. Nail new subflooring and finish flooring over the joist extensions to extend the floor area.

Install the window, if it is a floor-to-ceiling unit, or frame the enclosed part of the bow and cover with exterior plywood bent to the radius of the band.

Close in the top of the window with roofing, if needed.



Loop-Charging and power shifting.

Two reasons the Johnson 50 leads its class.

Our Sea-Horse 50 hp.

No other outboard in the mid-horsepower range can come close.

Here's why:

The Johnson 50 is Loop-Charged. That's a powerful way of saying we charge each cylinder with a cleaner fuel-air mix and exhaust the gases in a continuous power loop. The result is more horsepower, more miles per gallon.

Then there's single-lever power shifting. So smooth even a junior skipper can operate it. Our power shifting is, in fact, up to 30 percent easier than manual shifts.

Starting is easier, too. MagFlash™ CD ignition sends 40,000 volts of white-hot spark to the plugs in less than three millionths of a second. For the fastest, surest starts in the

business. Along with smoother idling, trolling and running. MagFlash has no moving mechanical parts. No belts. No points. And you get long, long plug life.

And the 50's exhaust tuning helps to make a fast boat even faster. Gives you more power and performance on less gas. Perfect.

See the man with the world's best selling outboards. Your Johnson dealer. Look over the 50 and our other Loop-Charger, the Sea-Horse 65.

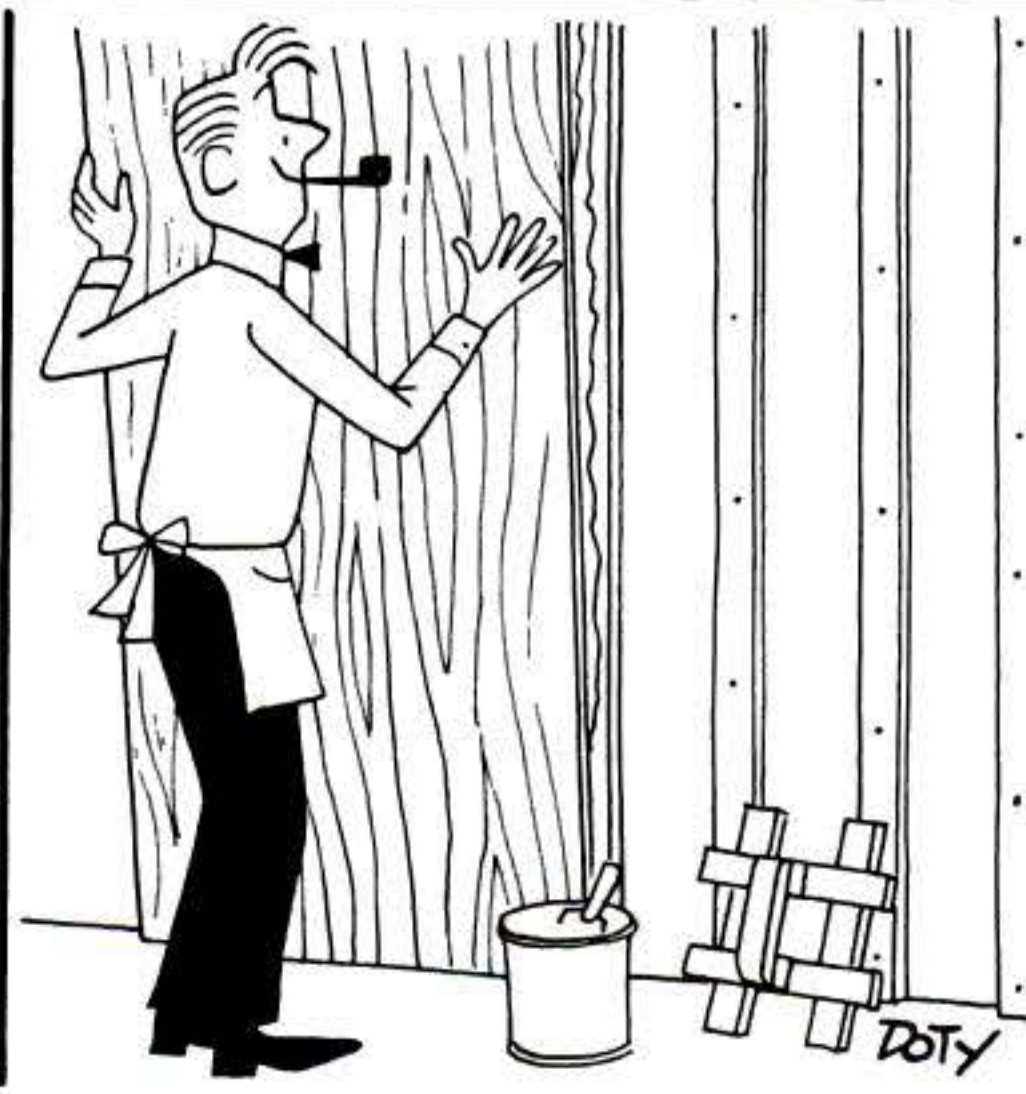
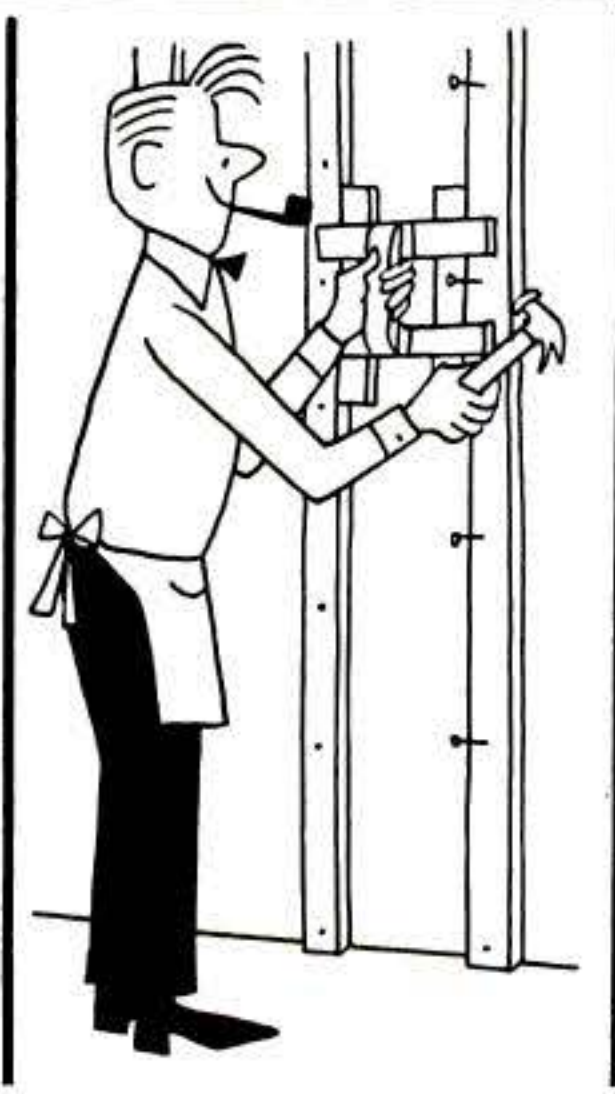
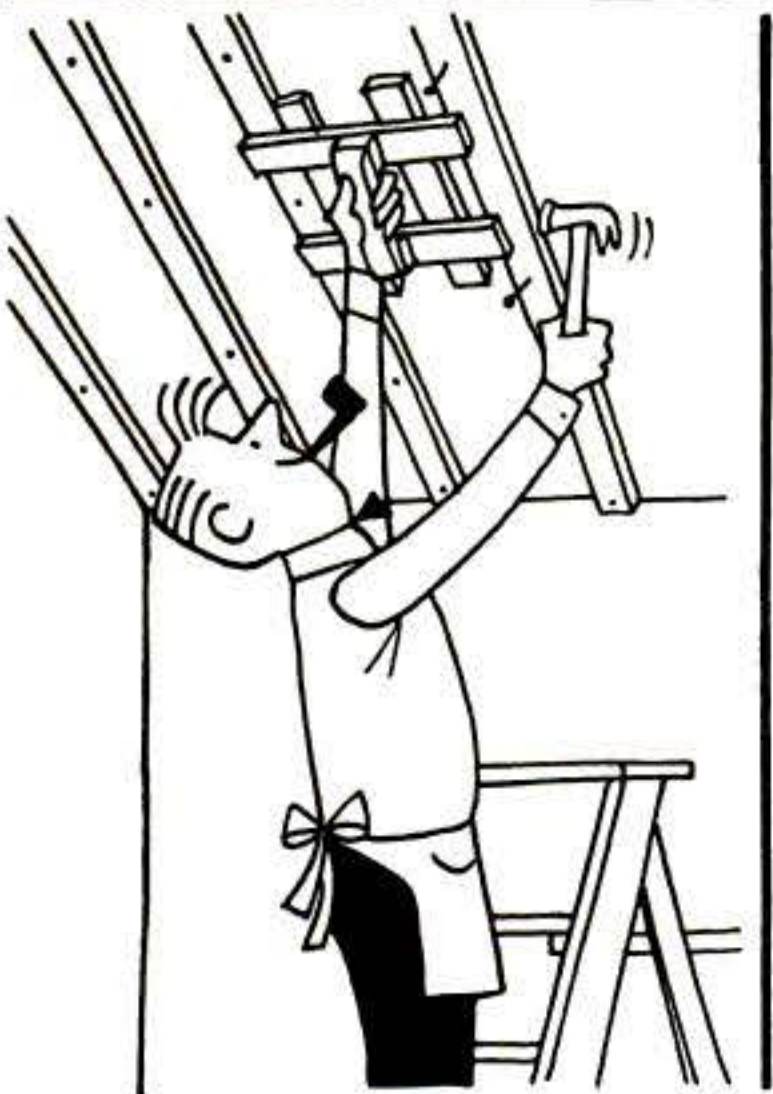
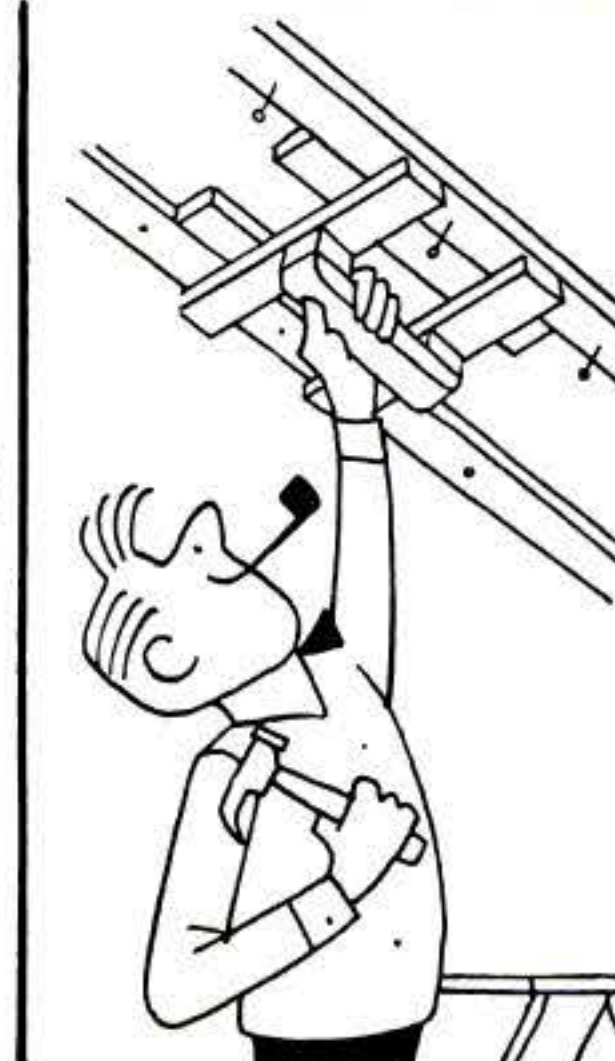
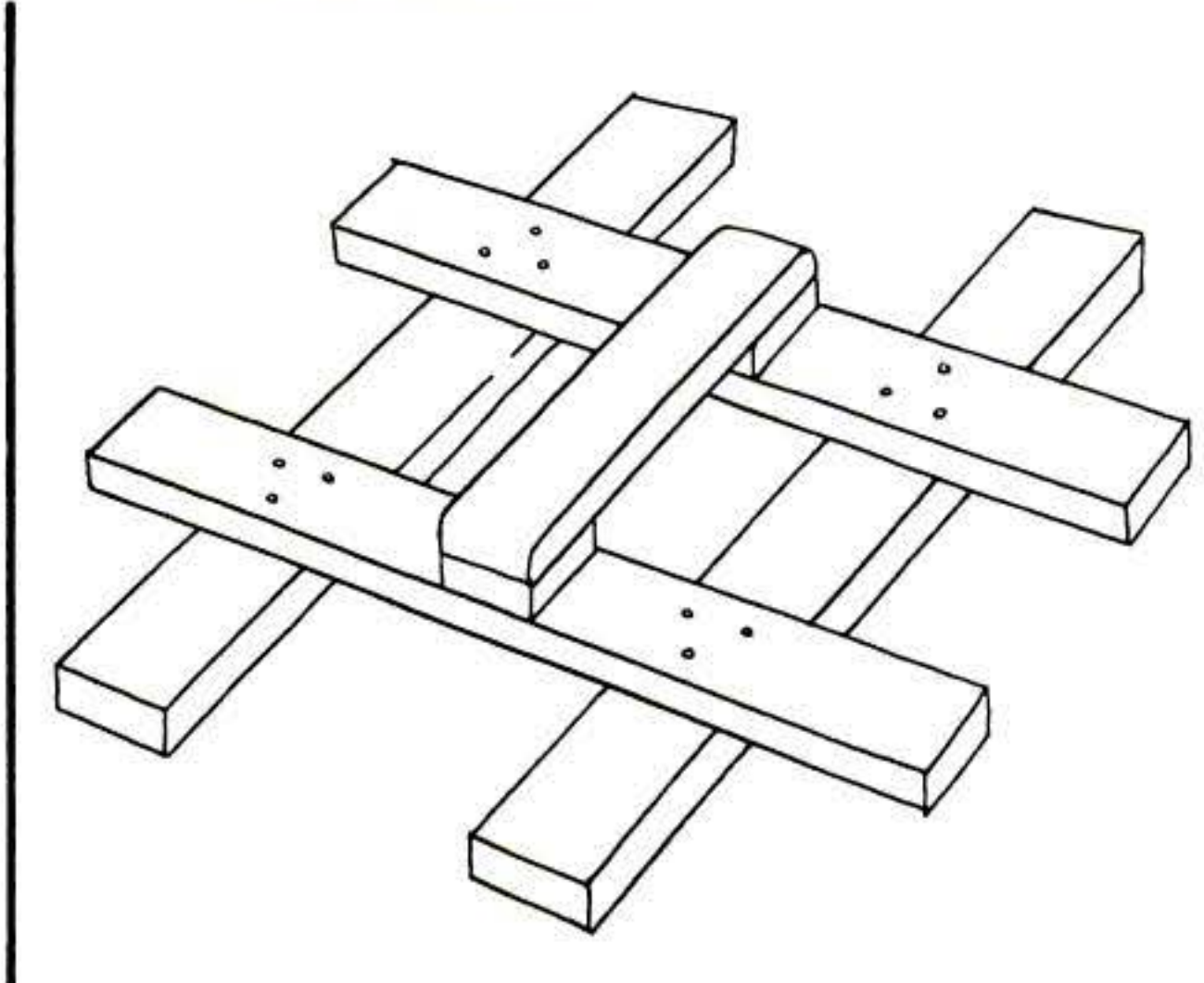
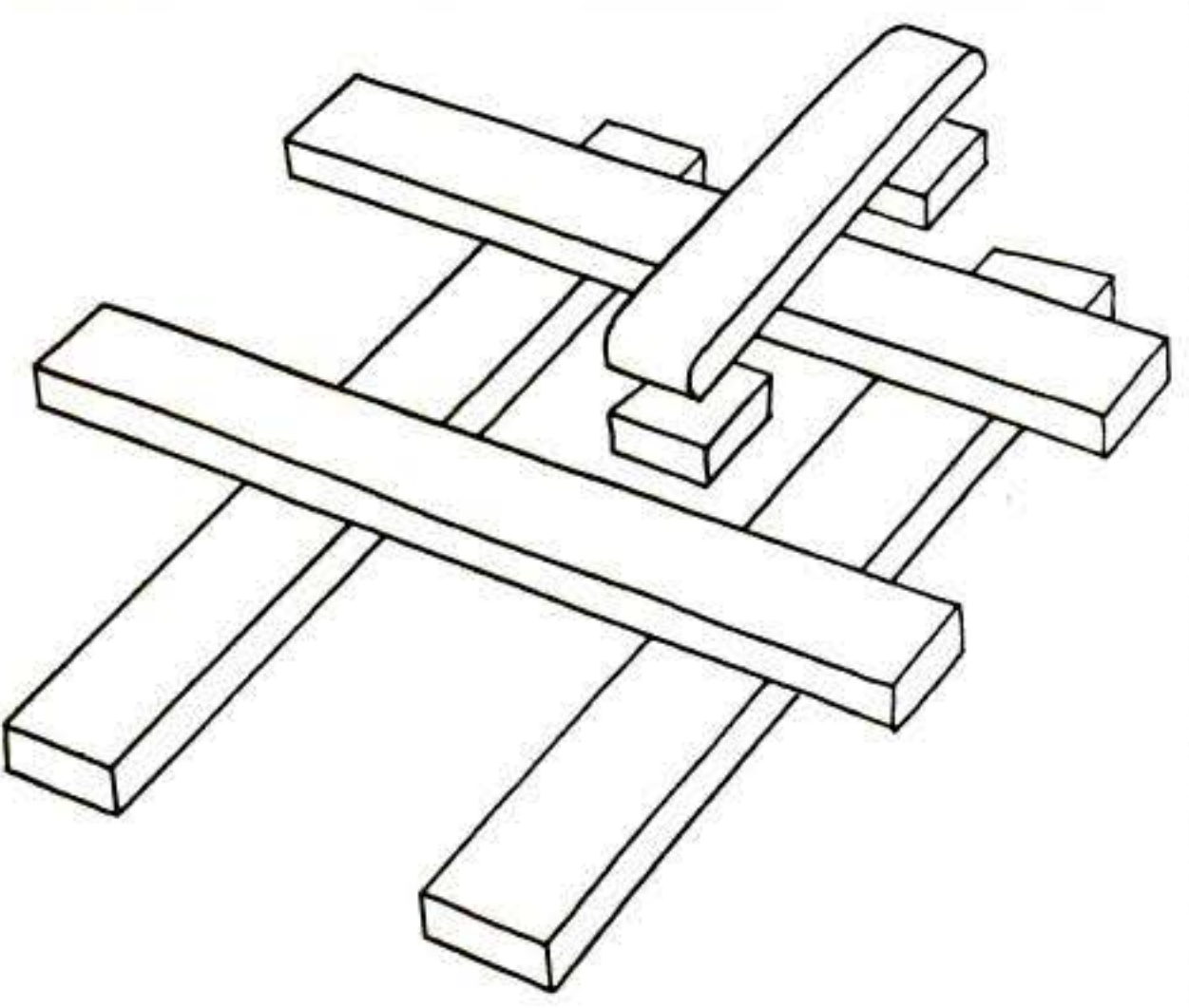
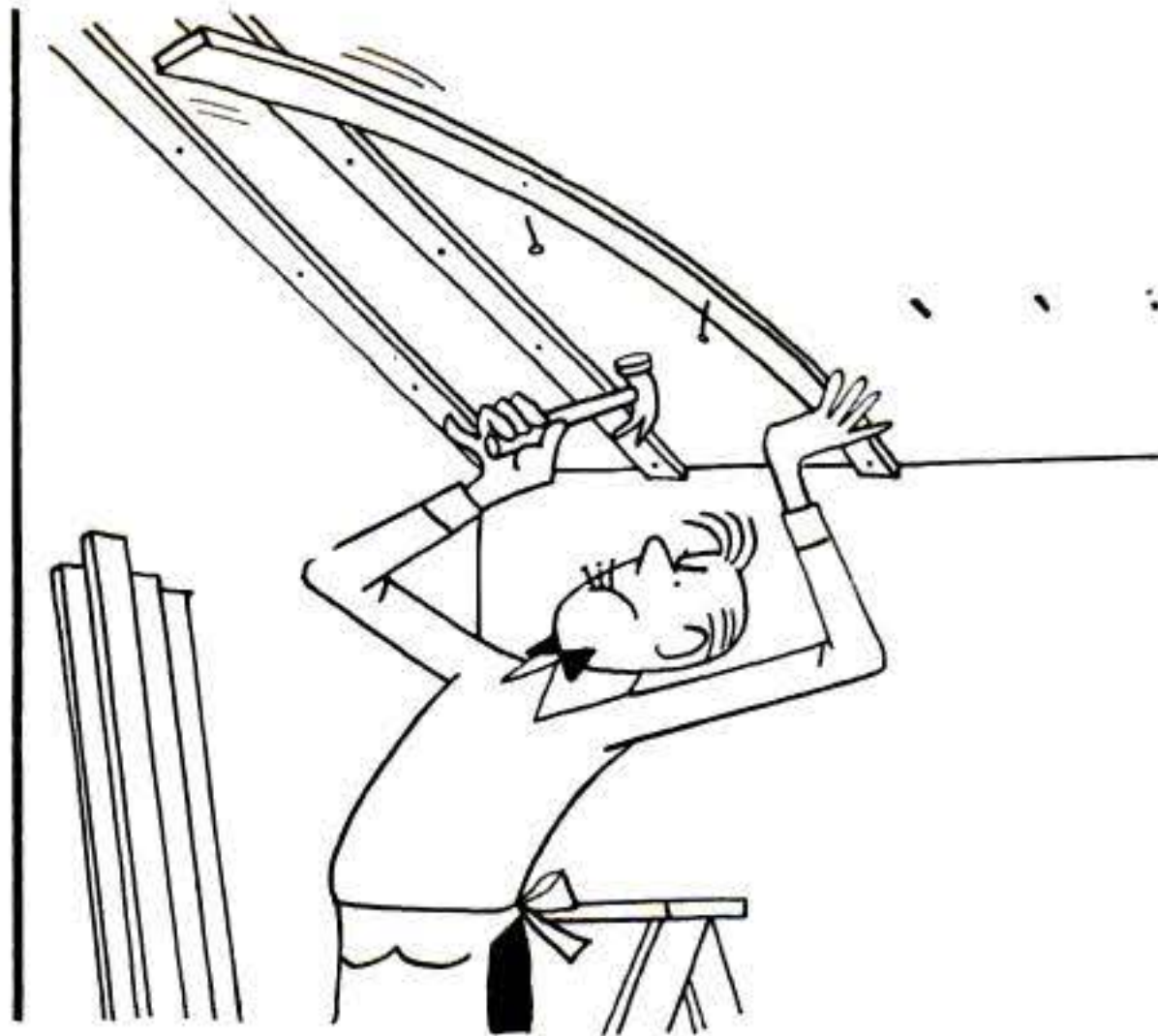
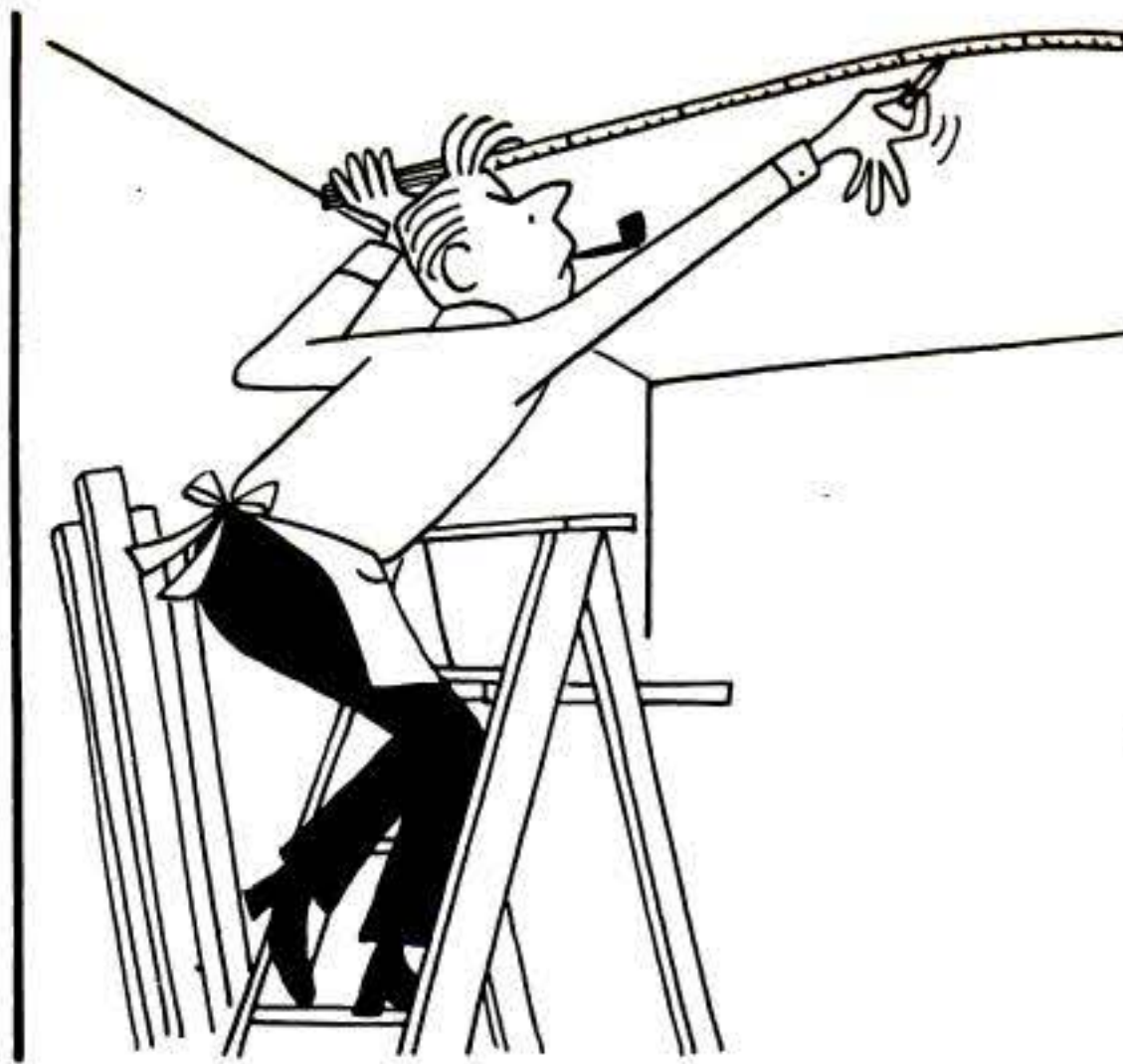
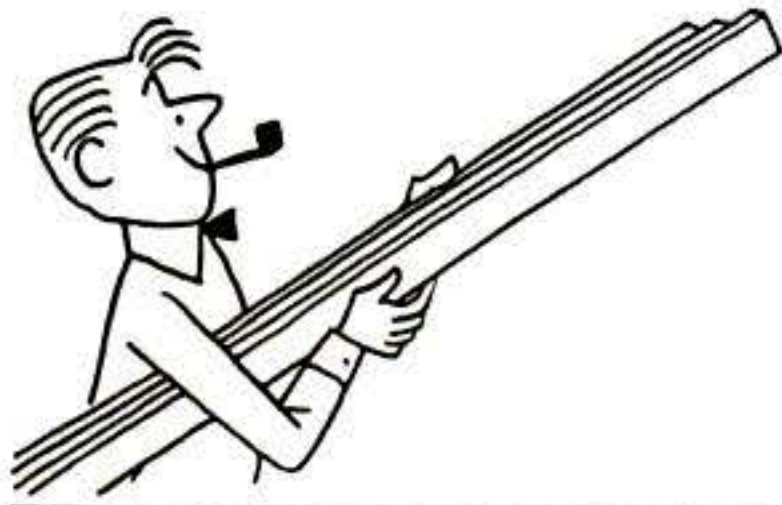
We taught them everything we know. Write for our 50th anniversary catalog.

First in dependability.
Johnson



Wordless Workshop

By ROY DOTY



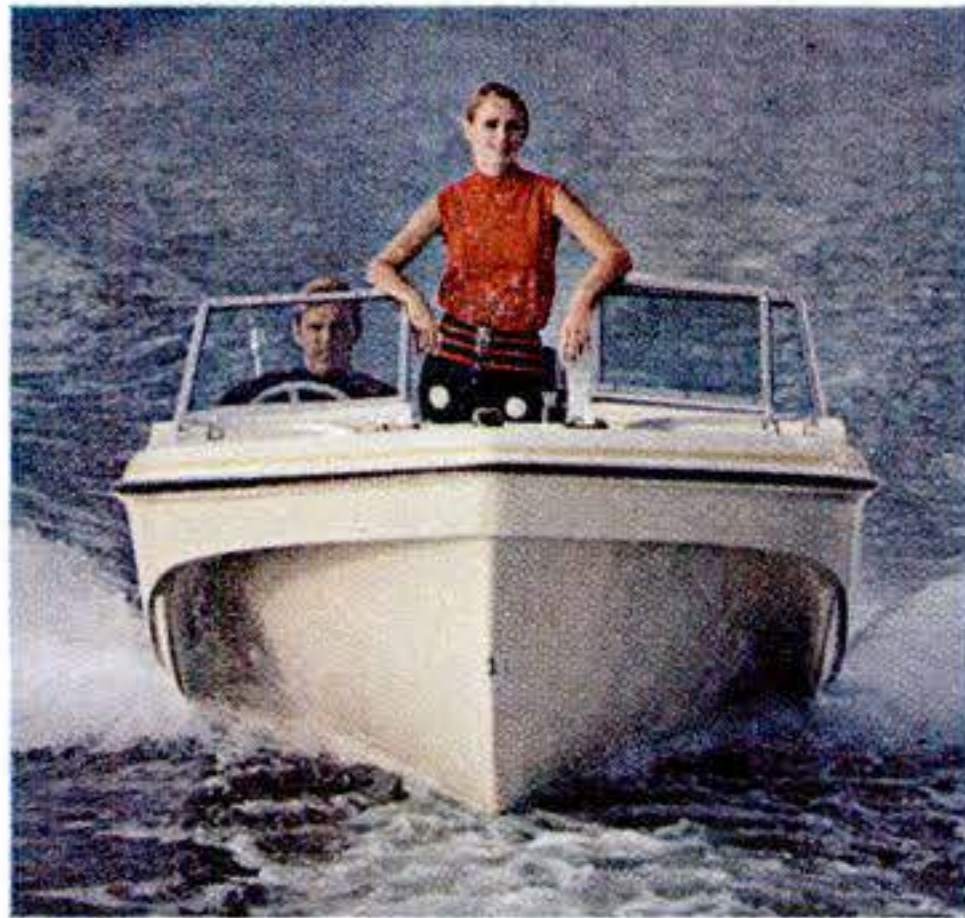
A few words about bottoms. Ours and yours.

It used to be that a small boat in any kind of sea meant a lot of beating and pounding and rolling and bouncing. For the boat. And for you.

Then the cathedral hull came out. And while it still did some bouncing and pounding, everybody thought it was the greatest thing since sliced bread. Everybody but the guy who designed it.

Dick Cole knew his new hull could be improved. He knew that somewhere there was a bottom design that would ride drier than a deep-V, and more stable than a cathedral, and smoother than anything else in the water. He knew it might take years of research and design. But he knew he'd find it.

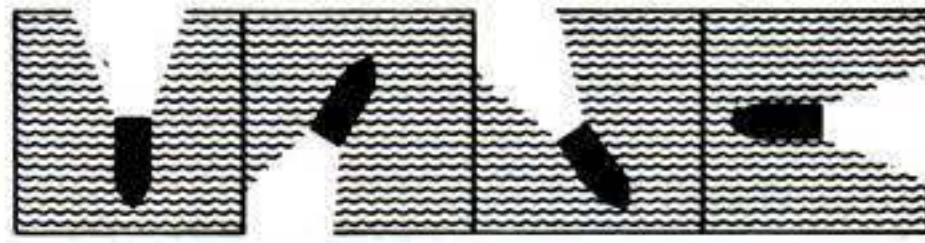
He's found it.



The secret of the new Airslot hull: Three V's and two slots.

This new Airslot hull is actually three true V hulls. Each sponson is itself a small V, not just an extension of the hull side. This design keeps the boat from rolling.

It keeps her from turning



A smooth and stable course in any direction.

on the crest of every wave so you don't have to keep fighting the wheel to stay on course. And, maybe the best of all, it keeps her stable at any angle to the sea. At any speed. In almost any sea.

The Airslot bottom also has a diagonal slot across each side of the center hull.

That means two additional leading edges. And that means you get up and plane fast. With no rearing up. And no flopping down.

What's more, these two additional leading edges give exceptional fore and aft stability so there's almost no pounding, no pitching, no spray over the bow, and no busted bottoms. Inside the boat or out.

Altogether, a hull that's designed to ride better than any small boat in the water.

And built to keep doing it for years.

Pre-tested materials and real double bottoms.

We start off with the best materials in the industry. Then we test everything before it even gets close to being a boat. That way we know that our aluminum gas tanks won't leak, that the safety glass for our windows is flawless, and that the fiberglass and resin we use is the strongest. After the boats are built, they're tested again for sub-surface flaws—every boat, every time.

A lot of different manufacturers call

a lot of different setups double bottoms.

We start with a fiberglass hull with glassed in stringers, and then cover it with a plywood sub-floor sealed with fiberglass. Then we add an all fiberglass innerliner with its own floor of 1/2 inch plywood sealed in. The floor and sub-floor are then bonded together under pressure with fiberglass—that's what we call a double bottom.



The Airslot Line

We own the Airslot design. And we've come out with a great new line of boats with exclusive Airslot bottoms (including the new 185 Airslot Sports, shown). Models from a 16' bowrider to a 24' cabin model. And each in outboard or inboard/outboard with a super list of standard equipment.

Free color catalog.

Take a look at the new airslot line at your dealer's. Or send for our free, full color brochure. Wellcraft Marine Corp., Sarasota, Florida 33580.

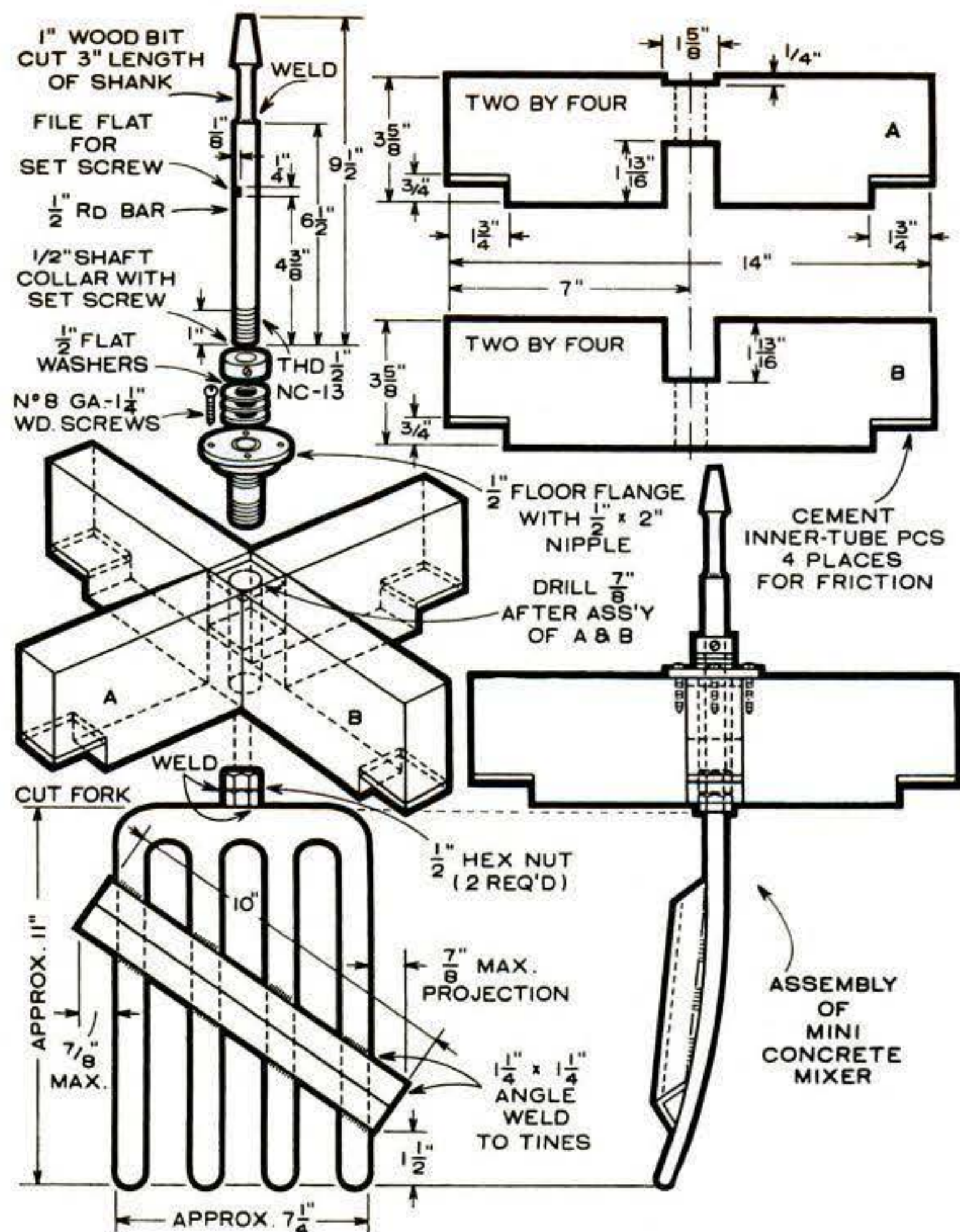
It's been a long time since anything this big has happened in small boats.

Wellcraft Airslot.



* Airslot is a trademark of Wellcraft Marine Corp





HOW TO MAKE A Mini Mixer for Concrete

By GREG A. NOVAK

When only a small amount of concrete is needed, this hand mixer is more than adequate to the task. You do the mixing in discarded five-gallon paint cans. Using a series of them, you can set up a production line. While Junior is pouring the contents of one can into place, Mom can be measuring out the ingredients into another as you use the mixer in a third. A great idea!

You use a carpenter's brace to do the turning. I made the rig in less than four hours, including a trip to a local arc-welding shop.

Cut the garden fork level with the top of the tine bar. Thread one end of the shaft $\frac{1}{2}$ NC-13 for a thread length of 1". Turn the two hex nuts on the shaft and weld the nuts together. Weld the lower nut centrally and perpendicularly to the top of the tine bar of the fork. Weld the angle iron to the fork tines. Hand-file a flat $\frac{1}{4}$ " wide by $\frac{1}{8}$ " deep on the $\frac{1}{2}$ " shaft, starting $4\frac{3}{8}$ " from its threaded end.

Cut a 3" length of shank, including

the brace end, from the wood bit, and fillet-weld the bit shank centrally in line with the shaft to the shaft's unthreaded end.

Make pieces A and B from the two-by-four stock. Assemble these and centrally drill a $\frac{7}{8}$ " hole in line through these assembled pieces, at their intersection. Thread the $\frac{1}{2}$ " nipple into the floor flange, spot-welding it in place, and insert the nipple into the $\frac{7}{8}$ " hole just drilled. Screw the floor flange to the connected pieces A and B with $1\frac{1}{2}$ " round-head wood screws, using two screws per piece.

Completing the assembly. Slip the shaft collar on the shaft, turning down the setscrew solidly onto the filed flat. Slip the threaded end of the shaft through three 1/2" flat washers and through the short nipple, screwing the shaft end firmly into the fork's hex-nut coupling.

On the underside of each of the notched ends of pieces A and B, cement a piece of inner tube. Slap a coat of cheap paint on the wood, or oil it with crankcase oil.

Insert the fork into a five-gallon paint can. The underside of the

notches of pieces A and B will rest on the can's rim and prevent the shifting of the assembly within the can.

Through the openings provided by the two-by-four frame, pour cement, sand, and gravel ingredients. After adding water, press down hard on the brace and turn *clockwise*. The mixing will become increasingly easier with each revolution, resulting in excellent, well mixed concrete. After mixing has been completed, remove the mixer from the can.

To clean both mixer and cans after finishing the job, fill cans with water and insert rig into each, in turn, stirring until both rig and can are clean—ready for the next time you need a small batch. **PS**

MATERIALS LIST

Small garden fork, about 11" long
and 7 1/4" wide

1" or larger wood bit

10" length of 1 1/4"-by-1 1/4" angle

28" length of two-by-four S4S
6 1/2" length of 1/2"-dia. shafting

Discarded tire inner tube

Hardware: 1/2" shaft collar

Hardware: $\frac{1}{2}$ " shaft collar with set screw, two $\frac{1}{2}$ " hex nuts, three $\frac{1}{2}$ " flat washers, $\frac{1}{2}$ " floor flange, and $\frac{1}{2}$ "-by-2" pipe nipple

Get away from the crowd.
Get the flavor you want in
Old Gold Filters.



20 mg. "tar," 1.2 mg. nicotine av. per cigarette, FTC Report Aug. '71.

© 1971 Lorillard

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Eight-foot panels combine 18-inch shingles with a strip of half-inch sheathing plywood (along top edge of shingles). The result is a one-step roofing/sheathing system.

Real Shingles—a fast, new way

Cedar shingles make a beautiful roof. They weather to a fine natural tone, and provide complete weather protection for years. Only one problem—it's a lot of work to nail them in place.

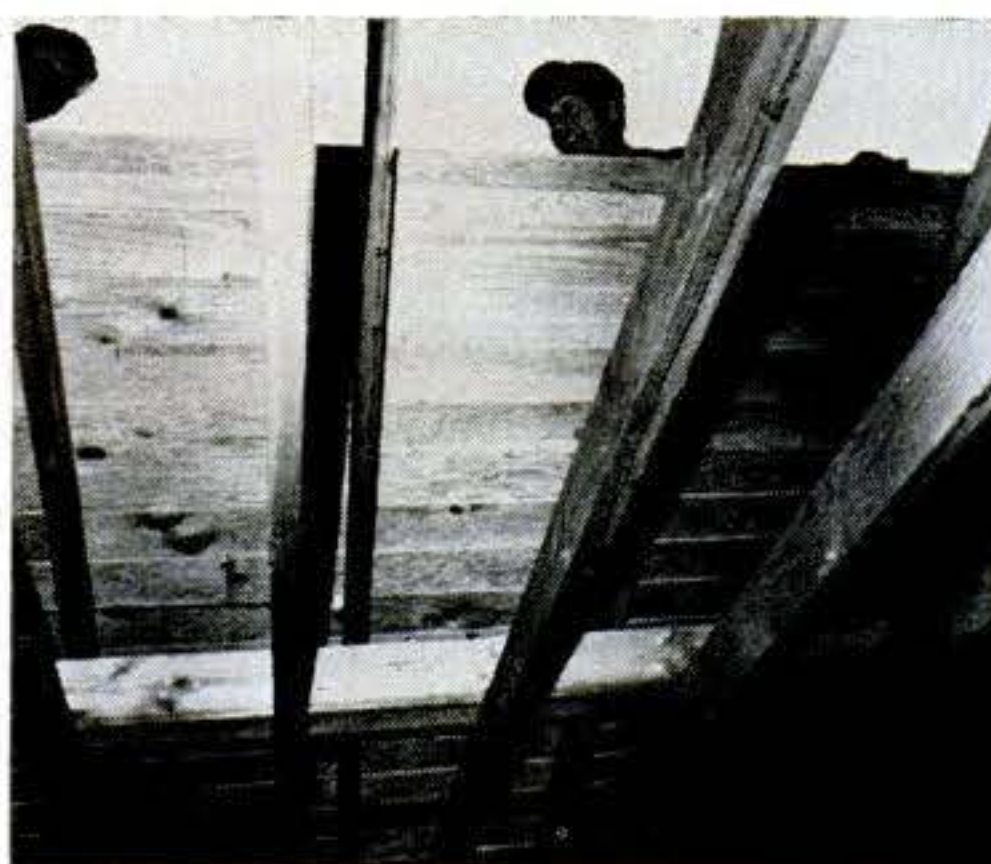
Now Shakertown Shingle Roof Panels make the job easy. The panels combine half-inch sheathing-grade plywood and a selection of random-width shingles, bonded together into a solid eight-foot unit. You apply both sheathing and shingles at one time—nailing only at rafters on 16- or 24-inch centers.

The old problem of keeping shingle courses in a straight line is eliminated, too. Once the starter course is in place, each additional course falls automatically into line. You get a neat, uniform weather exposure of six inches.

How do the panels handle? They're surprisingly light in weight. You'll

have no trouble handling them all by yourself.

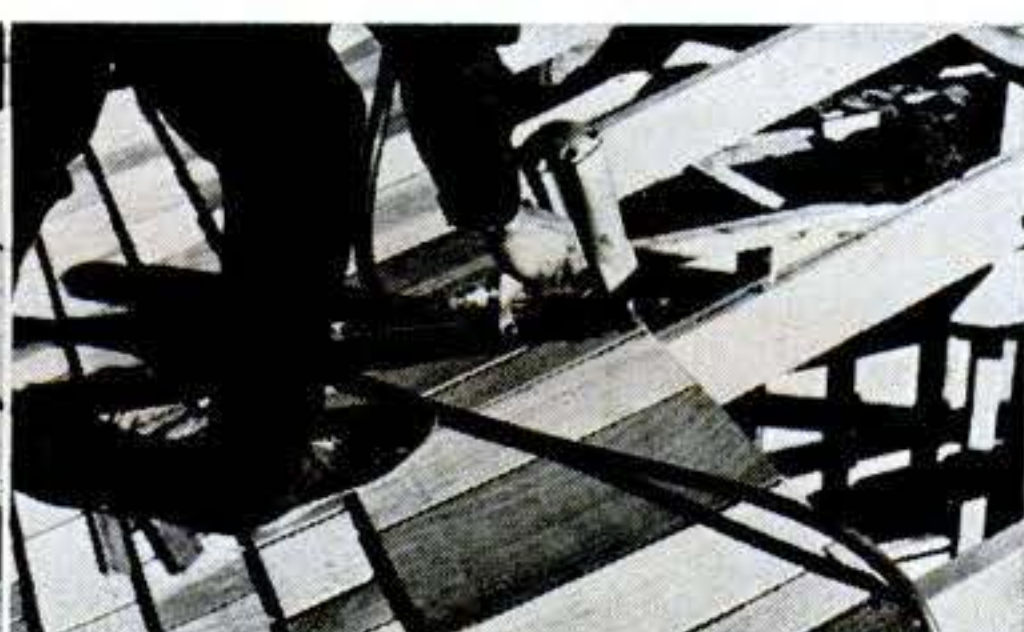
They're made by Shakertown Corp., 4416 Lee Road, Cleveland, Ohio 44128, and sold nationwide.



View from below shows how the sheathing plywood strips form a continuous underlayment when nailed to rafters. Roofing is designed for 4/12 pitch or steeper.

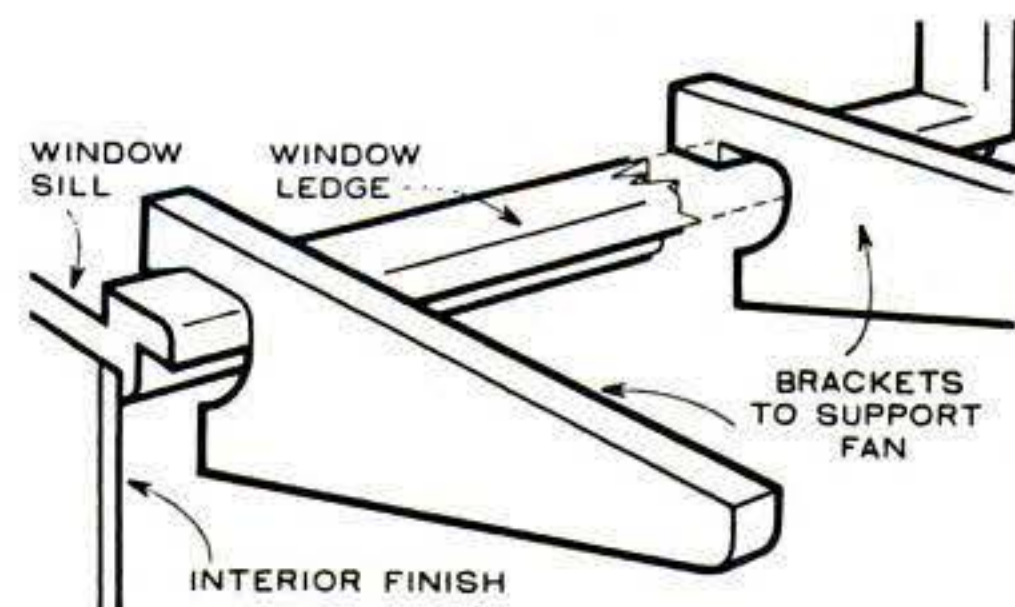


Panels may be joined between rafters if necessary. Use plywood clips for stronger underlayment. The joint will be bridged when you apply the next course of panels.



Just two nails per rafter fasten the panels in place. Normal shingling technique requires two nails per shingle. Rust-resistant or zinc-coated 6d nails are recommended.

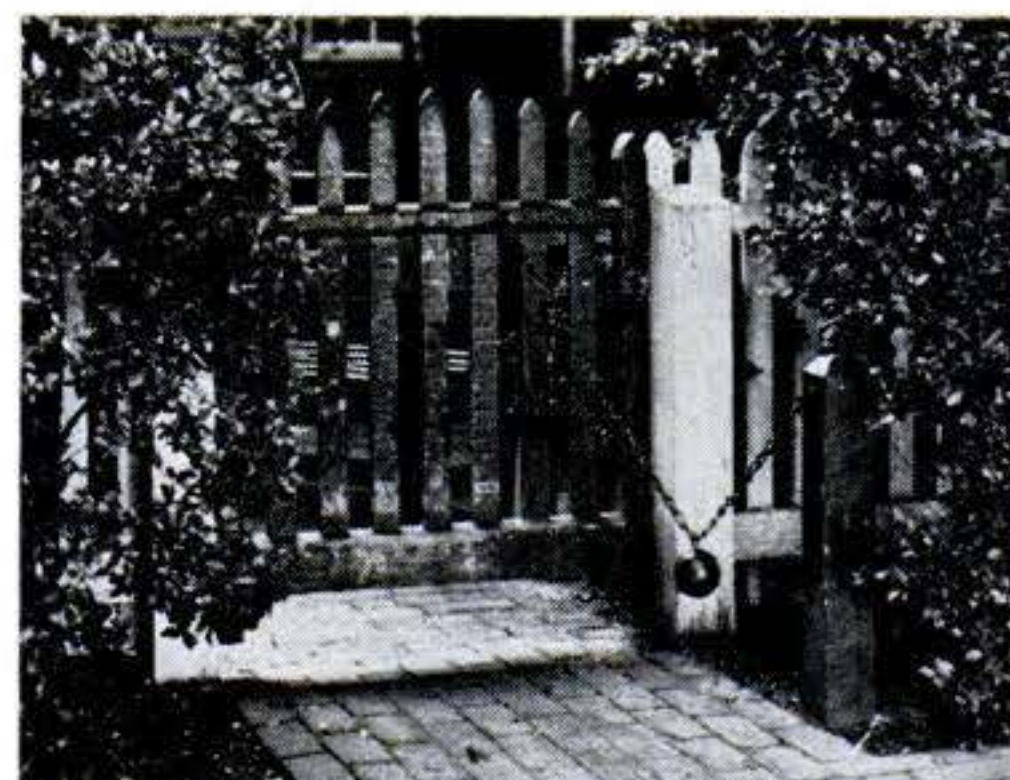
SHORT CUTS AND TIPS FROM HERE AND THERE



Window-fan brackets

A pair of brackets cut from plywood to fit your window ledge will provide sturdy support for a large fan. They're removable—just hook in place—so you can move the fan from window to window. Come winter, store with the fan. Check your window ledges to determine the dimensions of the "hook."

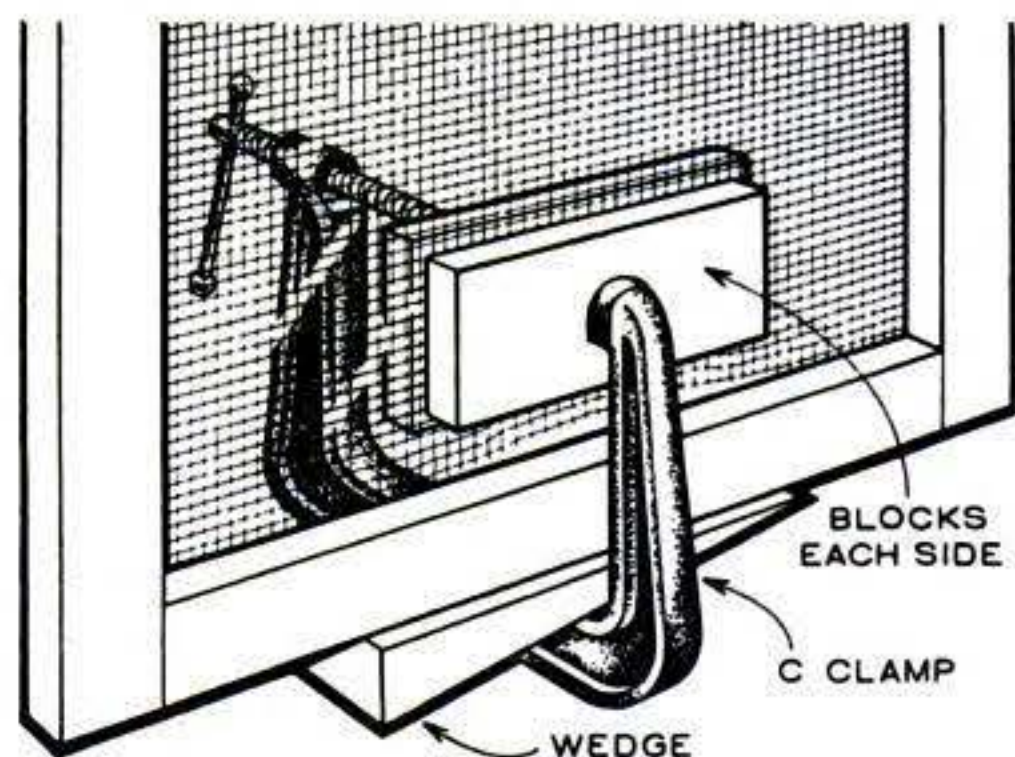
C. G. PATOCKA, Downey, Calif.



Weight that gate

Want a simple, effective gate closer? Borrow a trick from colonial times. Fasten one end of a four-foot galvanized chain to the gate, the other end to a post, and secure a steel ball to the center of the chain. Gate opens easily, but the weight of the ball will always draw it shut again.

HARRY REMINGTON, New York, N.Y.



Re-staple screening

Screening pulled loose from its frame? You can stretch it back into position with this trick. Clamp a pair of boards to make a gripper, as shown in the drawing. Then drive a wedge through the clamp to draw the screening into place for re-stapling. Large repair jobs may require two clamps.

WILLIAM BOOTH, Glen Ellyn, Ill.



1972 Roamer Wheel covers and awnings are extra-cost accessories.

Apache '72...we've built a solid case against canvas campers

Any way you cut it, canvas just can't measure up to the stuff the Solid State Apaches are made of: ABS thermoplastic. This remarkable material makes for a whole new concept in camping trailers. Solid walls. Solid roof. Solid bedrooms. There's no canvas anywhere. Which means you enjoy extra comfort in an Apache. Extra quiet. Extra protection. Plus a long list of convenience features exclusive with Solid State. Things like solid sliding windows, a lockable self-storing door and fully draped interior walls. What's more, ABS is weather-resistant, stain-resistant and virtually maintenance-free. It's the greatest thing to happen to folding camping trailers since Vesely Company



1972 Roamer

pioneered the Apache back in 1957. Eight new Solid State models range from \$1095 to \$1875 (higher in Canada). For your nearest Apache dealer, check the Yellow Pages under

"Trailers—Camping and Travel."
Vesely Company, Box 422,
Lapeer, Michigan 48446.



APACHE

**VESELY
COMPANY**



Easy-rolling cart has built-in bat rack up front. Inside there's plenty of room for

catcher's gear and batting helmets. Balls store neatly in a rack at top of the cart.

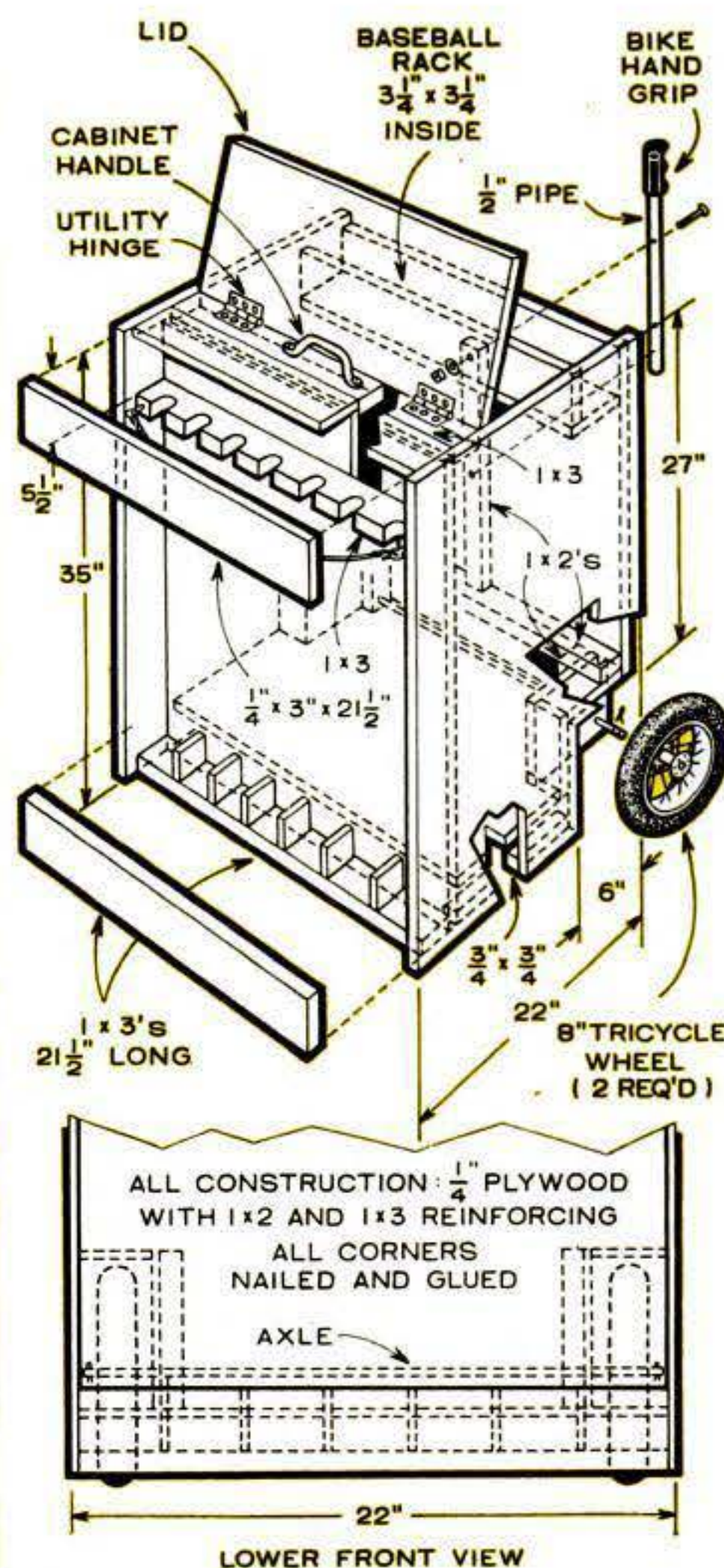
PS PROJECTS

How to Make a Little League Cart

It didn't take me long as a Little League coach to decide that the standard duffle-bag approach to equipment transport and storage is inadequate. So I designed and built an equipment carrier that happily solves the problems for my team.

Our carrier rolls like a golf cart—lots easier than lugging that heavy bag. The balls—always buried at the bottom of the bag—are easy to find in a rack at the top of the cart. An exposed bat rack built into the front of the carrier keeps bats in order during transport, practice sessions, and games.

Construction? Simple and cheap. A sheet of $\frac{1}{4}$ " plywood, some 1-by-3 pine, glue, nails, and a pair of tricycle wheels are all you need. Finish the cart off with the team name painted on the side, and you'll impress the boys, their parents, and your team's sponsor.—Gene Hall



NASA's New Mach 1 Airline

[Continued from page 70]

tems. Advanced gear will permit steeper and shorter approach to safe touchdown. Short and medium hop operations of the new breed of airliners will greatly benefit from improved operational flight patterns.

• Minor equipment troubles in flight, that most passengers never notice, plague airlines with delays on the ground. Normally, a flight crew radios ahead to report a part out of order so that a replacement can be ready at the destination airport. But in more than half of the cases, the crew's diagnosis of what's misbehaving is wrong—and a different part, not always handy, is needed. The ATT will locate a "glitch" more dependably with equipment lately pioneered on wide-body airliners like the DC-10—a highly sophisticated computer-aided fault-isolating system for service in flight.

Golden eggs for Uncle Sam. For ends besides aiding your travels and the U.S. airline business, developing these advanced airplanes is a national necessity.

Today the vast majority of the free world's airliners are American-made. But, for the first time since World War II, commercial-aircraft makers of western Europe and Japan are effectively challenging our \$28-billion-a-year aerospace industry—already in a deep recession because of our shrinking space budget and declining orders for military aircraft.

While we have canceled our supersonic transport project, the French and English are forging ahead with their supersonic Concorde. The Soviets will soon put their own SST, the Tupolev 144, into operation over their long domestic routes.

Far less well known is the fact that a brand-new two-engine European airliner called Aerobus 300-B is racking up sales all over the world to airlines that used American equipment almost exclusively before. French and West German firms developed it jointly, and at least one version is powered by British engines. The Japanese, already using one Japan-made turbo-prop on their domestic routes, are making elaborate preparations to enter the export market for modern jet transports.

If the U.S. is not to lose billions of dollars in aircraft exports, to the further decay of our tottering international balance-of-payments situation we must meet the new competition with a first-class competitive product—a truly superior Advanced Technology Transport. This will be the Mach 1 airliner that I have been talking about.

BOLENS HUSKYS FOR '72.

**Compact tractors that
get you off the lawn and
into the fun faster.**



That's what it's all about, isn't it... giving you a better looking lawn in as little time as possible? But there's much more to the Husky breed than saving your time and effort.

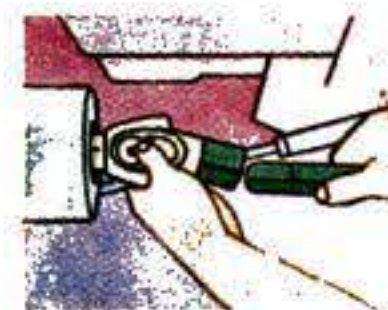
From 8 to 18 hp, each Bolens Husky® is backed by more than fifty years' experience in making rugged lawn and garden tractors. Fact is, Bolens invented the first self-propelled garden tractor and has been improving on it ever since.

Whatever your needs, wherever you live, your Bolens is a tractor for all seasons. Hitch up to over thirty work-saving attachments. Snow casters. Tillers. Blades. Graders.

See the Yellow Pages for your nearest Bolens dealer. He'll show you how easy it is to get off the lawn and into the fun faster with a Husky, the best breed you can choose.



The "Go-Go" Pedal. On larger Huskys. You control speed, forward, reverse and dynamic braking with one pedal. You never take your hands from the wheel to shift.



Plug-In Attachments. Snap on and off in a hurry. No-belt, direct linkage lets you use all the muscle that's built into your Husky.



Bright Headlights. And taillights, too, are standard on most models so you can see to mow the lawn at dusk after work. Or rid your driveway of snow at night.

Bolens, Husky and Bolens Husky are Registered Trademarks of Bolens Div., FMC Corp.



BOLENS

BOLENS DIVISION, FMC CORPORATION, PORT WASHINGTON, WISCONSIN

**Bolens Huskys—a breed for every lawn
and garden need.**

Awning for a Sunny Window

[Continued from page 114]

flush with the top edge of the bow. Make sure that you turn the second end frame over so that you make a right-hand and a left-hand endpiece. (The two outside slats are not fastened to these end frames until the framing assembly is complete.)

Install the longerons. Their top edges must have varying angles, to match the bow arc. If you don't have

a jointer, a planer blade in your saw will do a fine job. Secure the longerons in the bow notches with 6d nails and white glue. Predrill nailholes.

Divide the space between endpieces into equal parts not exceeding 26", and install interior bows. The interior bows will have to be recut $\frac{3}{4}$ " less at each end than the end bows, to fit inside the longerons.

If the awning is over 54" long, split the interior bows for a box beam as shown, to keep awnings from becoming swaybacked. At this time fasten a temporary brace from the wall-mounting longeron to the endpiece bottoms. Leave it on until the awning is ready for mounting.

The last two slats on each endpiece can now be installed. Use plenty of

white glue; these two slats strengthen the wooden butt joints. Next, install the short slats across the front. Use the same bottom overhang and the same spacing as on the ends. Let the two outside slats on the front overlap the end slats. Stop the front slats about $\frac{1}{4}$ " below the top edge of the front longeron.

Rip all the top slats 3" wide and trim them to 36" lengths. Fasten the two outside slats with a $\frac{1}{4}$ " overhang beyond the slats of the endpieces. Fill in between the two outside slats with others spaced not more than 2". Apply the top row of slats to bridge the 2" space under them. Put a spot of waterproof panel adhesive under the top slats wherever they cross a longeron. Tack down the top slats with $1\frac{1}{4}$ " wire nails.

Paint the awning. Use the best exterior paint or enamel you can find. Apply the recommended undercoat. One finish coat is enough for the underside, but I always put three finish coats on the top and ends. You can paint top slats house-trim color.

Drill mounting holes at an angle through the mounting member. Fasteners should be long enough to enter the frame around the window. On masonry homes, install anchors. Put caulking compound between the top of the awning and the siding. **PS**

A SIMPLE SOLUTION TO PAINT FAILURE



The trouble with paint is that it forms a film. And when the weather starts working on this film, you get paint failure:

Cracking from heat and cold that stretch paint beyond the limit.

Peeling when the paint doesn't stick to what's underneath.

Blistering when there's moisture in the wood or under the paint.

That can't happen with Olympic Solid Color Stain. *It doesn't form a film!* It sinks into the wood and it breathes — can't crack, peel or blister. Olympic Stain costs less than paint, but it's so rich in pigment you can actually apply light colors over dark.

Whether you apply Olympic Solid Color Stain over new wood or a properly-prepared old painted surface, the stain will last longer, look beautiful, and stay trouble-free for years.

Send us the coupon and we'll send you a free folder that gives you all the details.



I've had it with paint failure. Please, send me the Olympic Stain color card and application folder to help me solve my paint problems.

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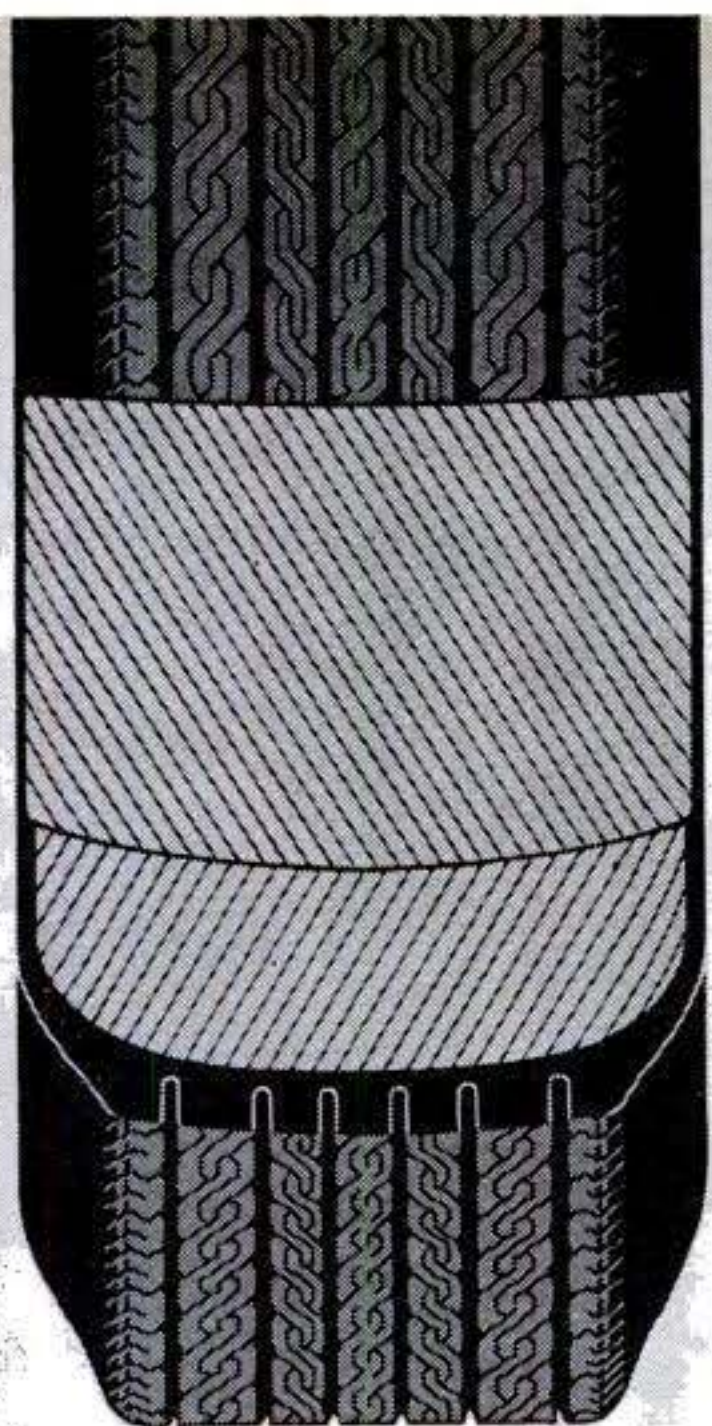
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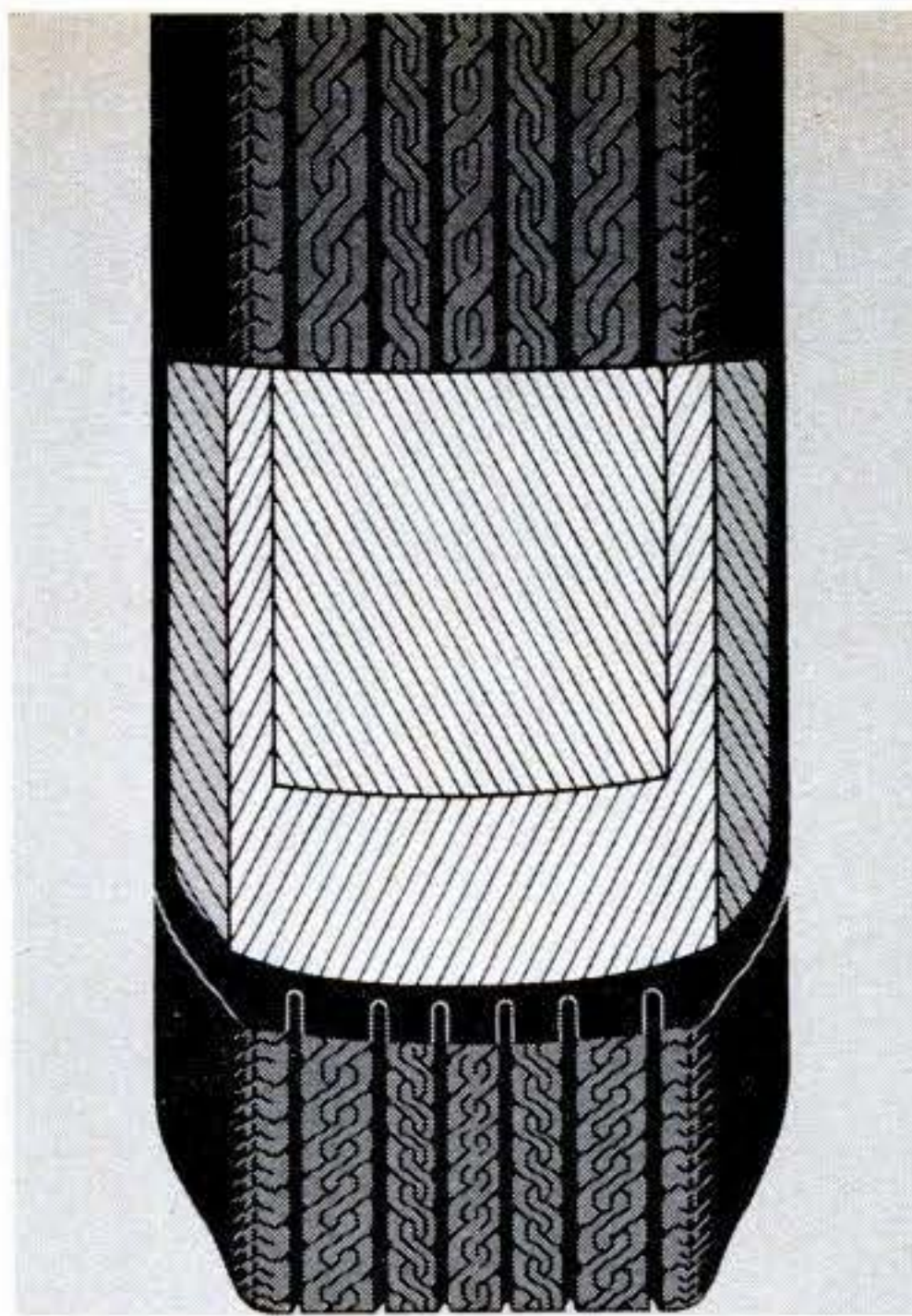
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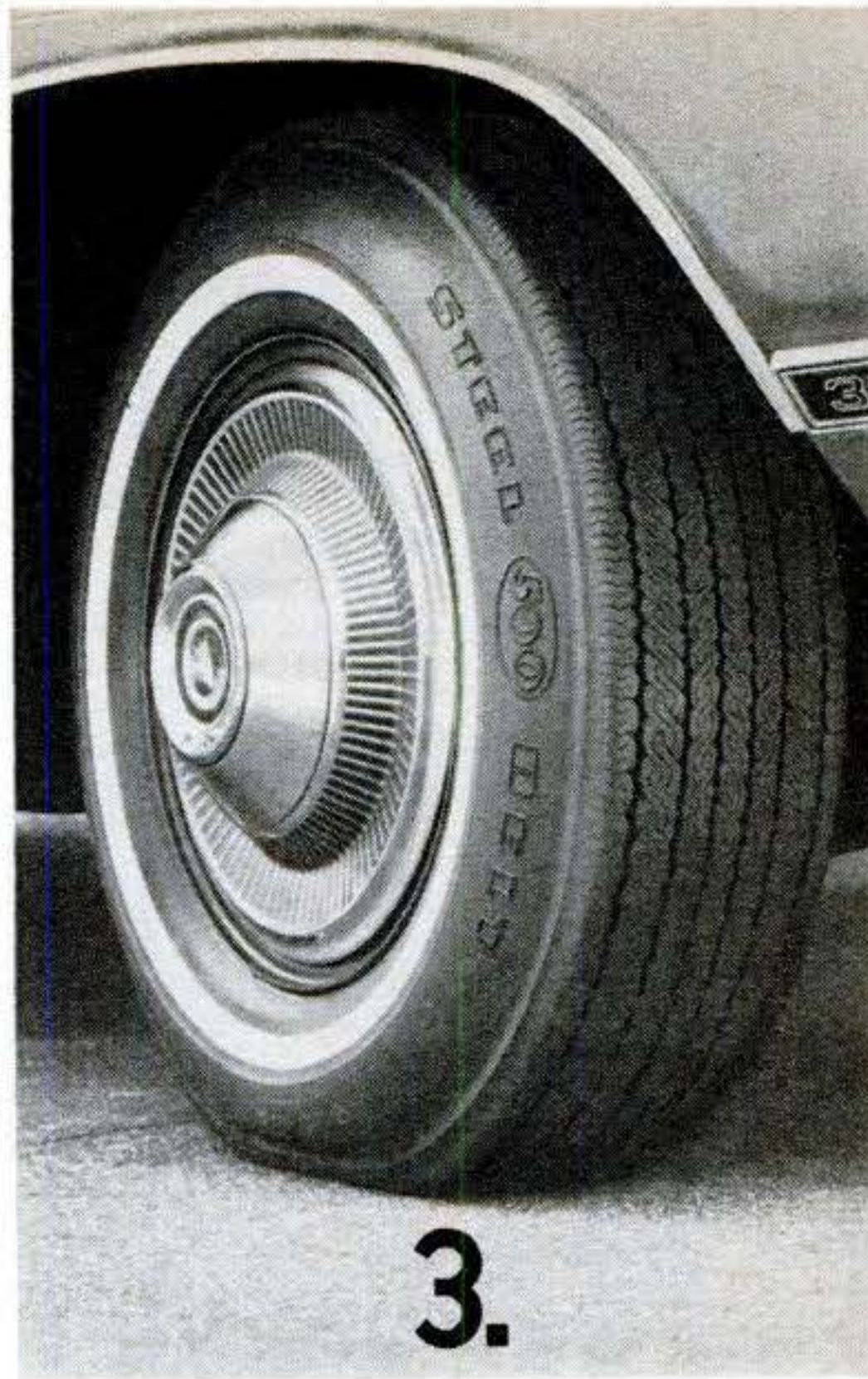
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1.



2.



3.

How to build the people tire.

The problem? Design a tough tire for a new world that has more driving for people to do, more curbs for people to run over, more people who are too busy to check their tires.

1. Give it strong polyester body plies, full tread depth, and a concave molded tread.
2. Put two armor belts of steel under the tread. Steel cords so strong a single cord will pull a car. Cords set so close together you'll need 805 feet for each tire.
3. Or simply see your Firestone Dealer, Store, or service station. You'll find we've already built The People Tire and it's ready for you.

We're not saying it's a tire you *shouldn't* take care of. We're saying that, with a little care, it will really take care of you.

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500 Steel Belt

the people tire

Taking Care of Your Car

Good hints others have used

Got a car tip? We pay \$25 for each one accepted. Send it to Car Care, Popular Science, 355 Lexington Ave., New York, N.Y. 10017. None are returnable.

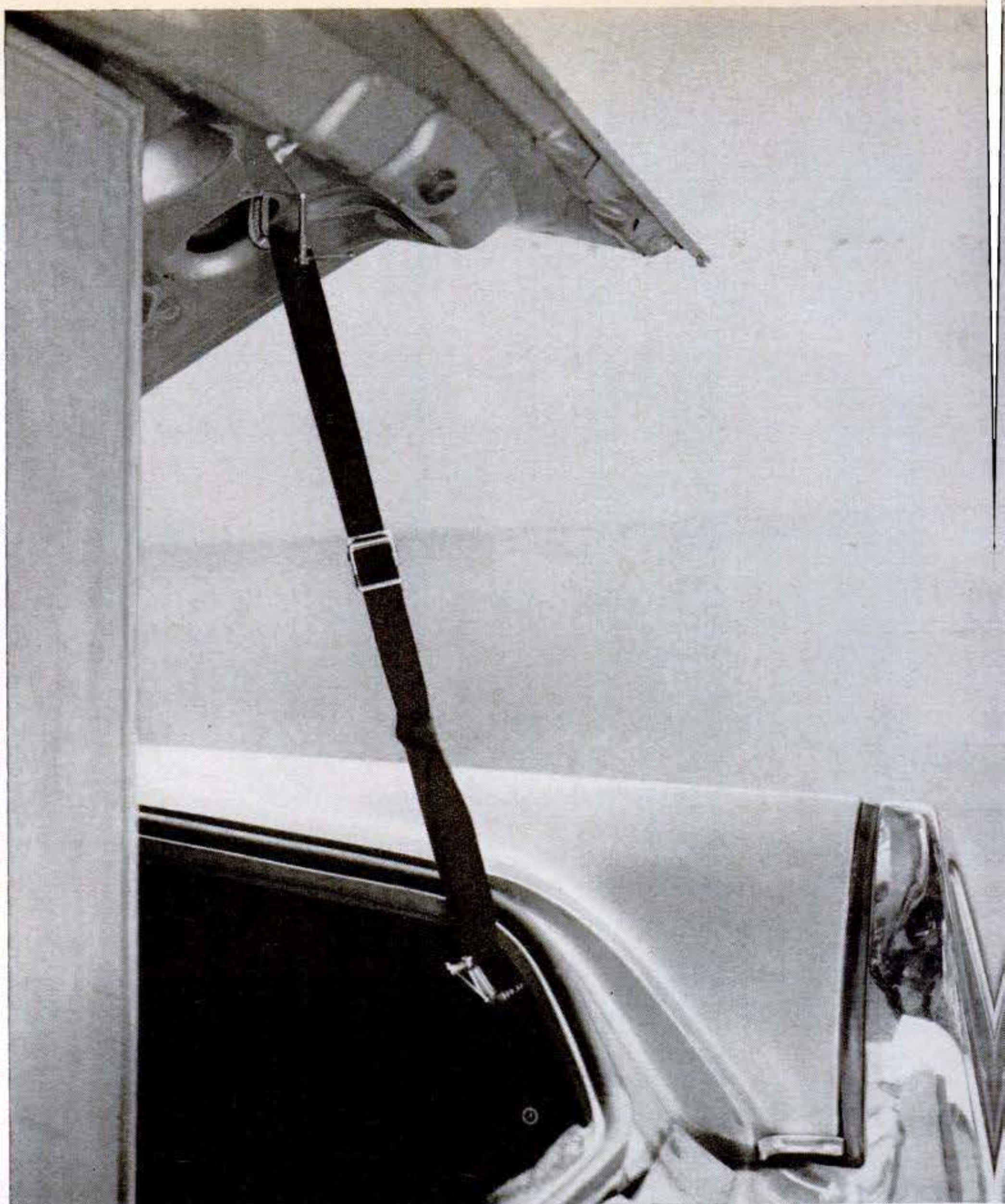


A scratch in your windshield? Often you can remove it by mixing an all-purpose cleanser with a liquid auto-paint restorer. Rub the mixture over the scratch with a soft cloth. The scratch should vanish.



Add muscle to your screwdriver by welding a hex nut near the handle. A wrench can then be applied to the screwdriver when you encounter a hard-to-remove screw that requires extra leverage to loosen.

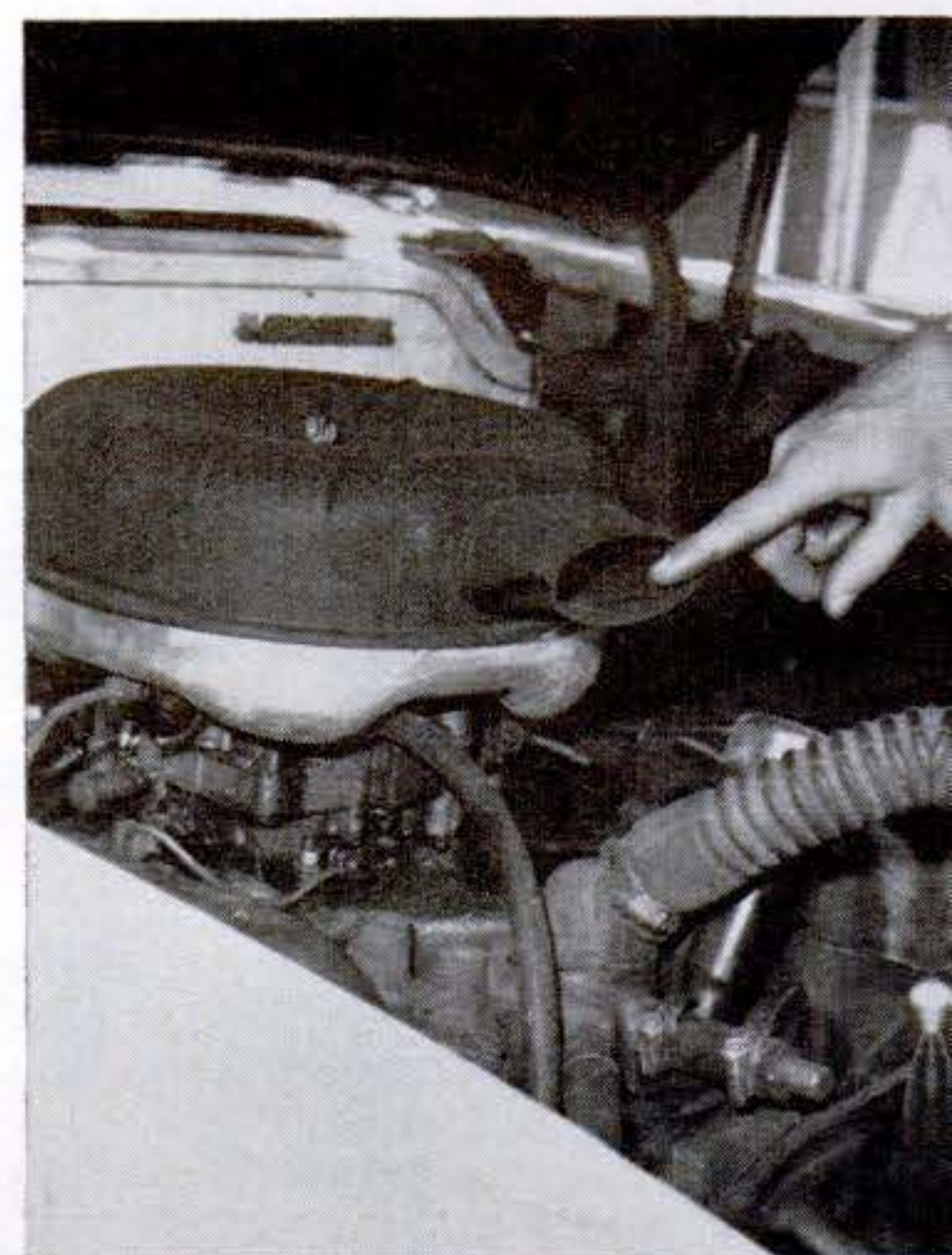
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Keep your trunk lid snug against outsized objects to prevent denting or warp. This tie-down lets you adjust tension at the start and during the haul. Attach two 1" C clamps—one under the lid, the other inside the trunk rim—and loop a luggage strap between.



A driver for seals and bearings can be made from pipe fittings: a reducer, cap, and a couple of short lengths of pipe. The tool assures that even pressure will be applied to the piece being driven in.



Wind whistle got you baffled? Check the air-cleaner housing. An air cleaner with the scoop turned toward the front can sometimes cause the noise. Turning the scoop toward the side solves the problem.



Any one of these four oils is right for your car.

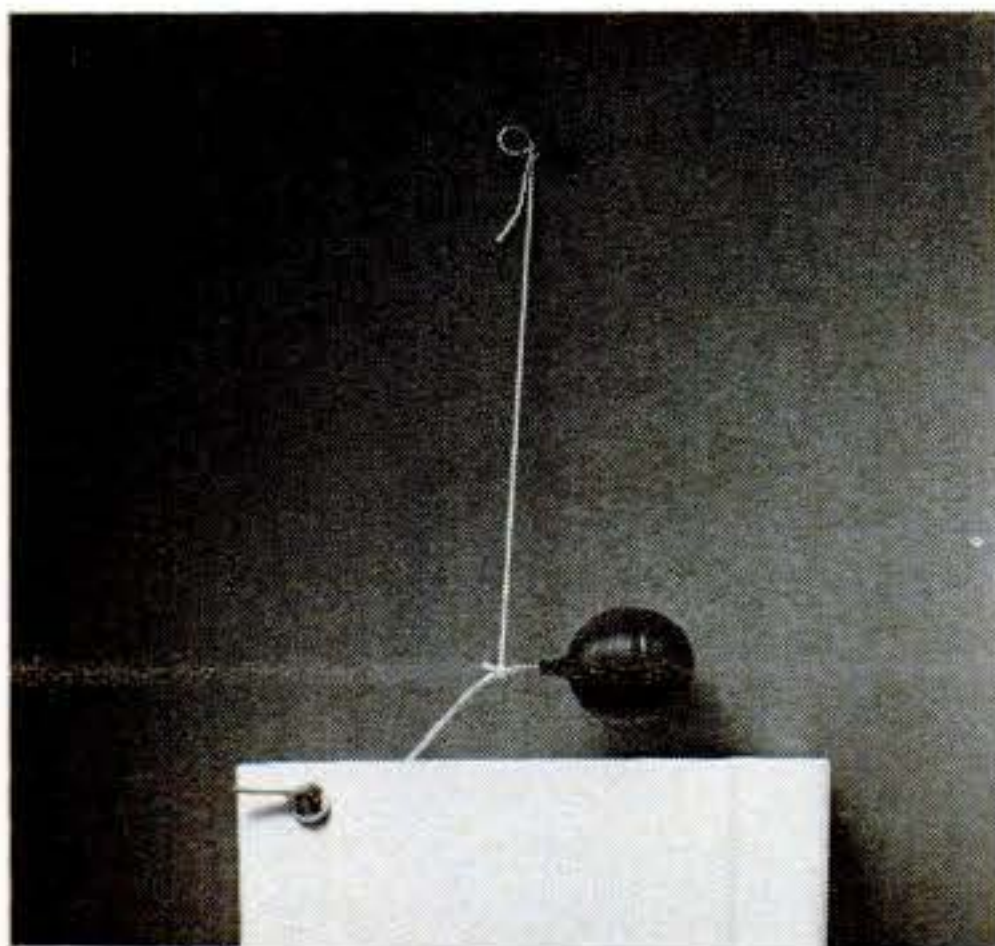
Sunoco Special takes all the worry and confusion out of buying the right oil for your car. You see, Sunoco Special 10W-40 is really four oils in one.

It does all the work of a 10W, 20, 30 and 40 motor oil. Sunoco Special is one oil you can use in both summer and winter—in fact, all year round. Sunoco Special meets or

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Sunoco Special. The long mileage motor oil.

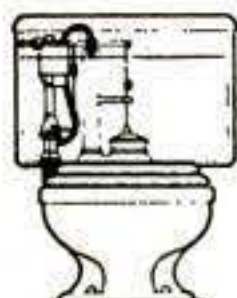


Two ways to stop toilet noise.

Leaks. Squeaks. Whines. Whistles. Ever try to live with the sounds of a leaky toilet ballcock? Some people do.

They jiggle the handle. Bend the rod arm. Even string the ornery critter up.

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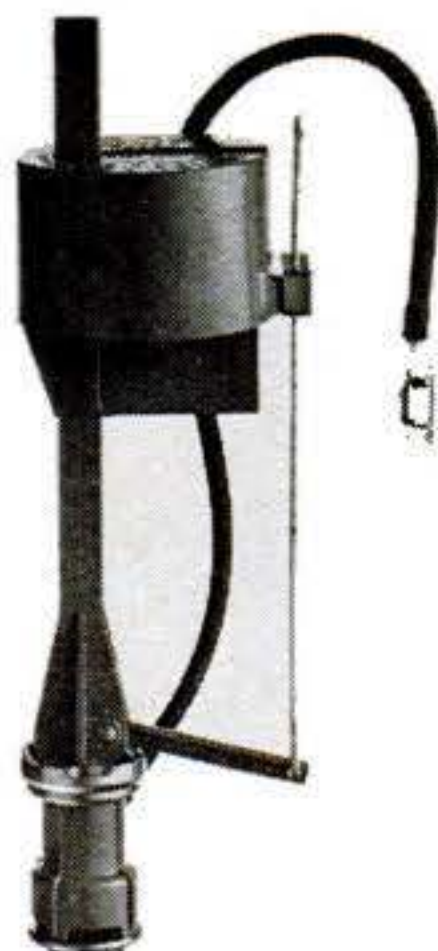
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Drive Your Nails with Air

[Continued from page 113]

staples, for easy loading and handling. One company (Spotnail) markets color-matched nails or brads that blend into wall paneling and trim. In this case, the finishing gun should be adjusted to drive the brads flush with the paneling.

Roundhead nails are available with various points such as: diamond—for common or all-purpose use; side cut—for clinching jobs; or blunt—for use where serious splitting problems are encountered. Lengths of these nails will range from the small 3d (1¼") through the large 16d (3½"). They come in common, box, cooler, ring-shank, screw-shank, and plywood types. These nails, too, can be purchased in various finishes such as plain and galvanized or cement-coated.

And the staples? Like the round-head nails, they offer the builder a choice of points, including divergent, chisel, and divergent-chisel. There are many specialty finishes offered in the staple line, among them, bright steel, galvanized steel, aluminum, bronze, monel, black oxide, tin-coated, and rosin-coated. The crown widths range from ⅛" to 1" and the lengths from ⅝" to 2½".

The question usually arises, "Will these staples really hold?" Yes, and much better than you think. Laboratory tests show that a rosin-coated, 16ga. staple with a ½" crown 1¾" long had 94 percent of the shear strength of an 8d common nail and 114 percent of a 6d common nail's strength, when a force was applied parallel to the crown of the staple.

All these fasteners go in very easily (160 to 200 per minute) but pulling them out is another ball game! That's when you start sweating. They haven't invented a pneumatic tool to remove nails and staples—you still have to do that the old way, wielding the pry bar.

How much do the nails cost? This varies according to the brand, type, size, coating, etc. Usually they'll cost two or three times the price you have been paying for a like fastener at the hardware store. That may seem high, but since nails are a minor item in construction—compared to labor—they're a bargain.

How about the guns themselves? They will cost from a few dollars for the small staple guns to nearly \$300 for the large nailing guns. But unless you're a builder your best bet is rental. The three-dollar-a-day figure I gave earlier isn't uncommon. If you don't own a compressor, expect to pay an extra five bucks or so a day to rent one.

PS



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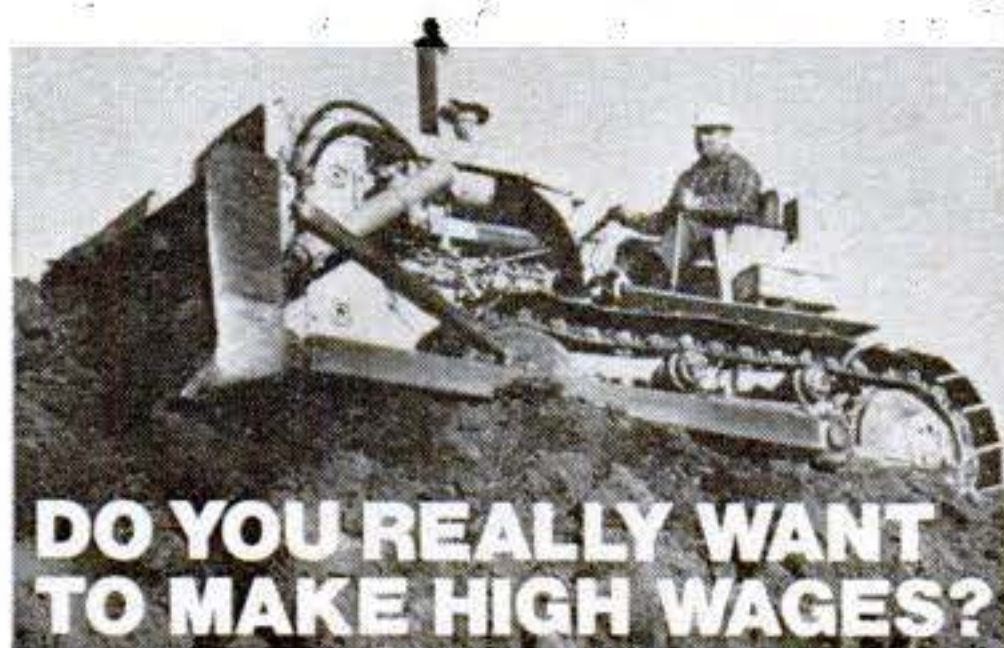
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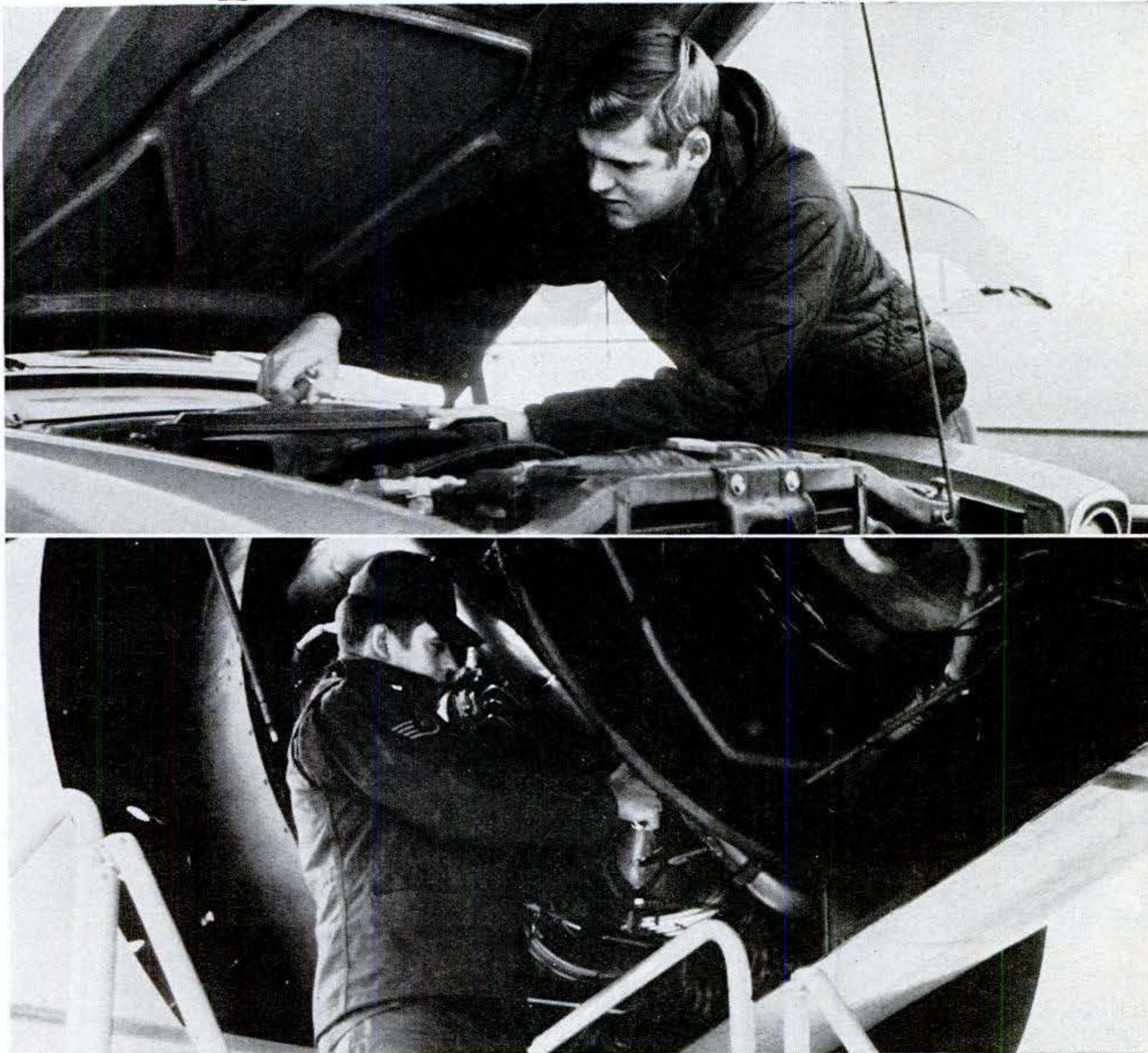
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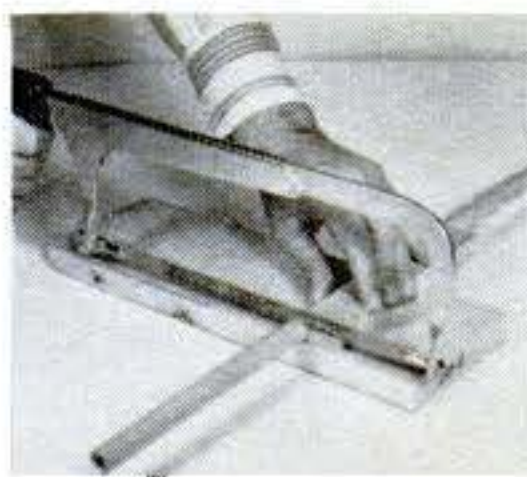
SHOP TALK

By ROBERT P. STEVENSON

New brochures and books for improving your home

Masonite, always a source of ideas for home improvement, offers a free 16-page brochure: "Living Ideas for Your World at Home." Send a postal to Masonite Home Service Bureau, Box B, Chicago 60690, asking for brochure 7110. Also from Masonite: an eight-page brochure, "X-90 Sidings Beautify the American Scene." . . . Information about painting (especially surface preparation), patching walls, cleaning brushes, removing wallpaper, repairing ceilings and floors, and cleaning the grout between bathroom tiles is contained in a 25-cent booklet available from paint stores or the Savogran Co., Norwood, Mass. 02062. . . . Do you like early-American styling in your home? You can learn how to achieve it with moldings by sending a quarter to Western Wood, Dept. X, Box 25278, Portland, Ore. 97225. . . . What do you know about wood as a building material? You might learn more from a free booklet, "Some Little-Known Facts About Wood," available from American Wood Council, 1619 Massachusetts Ave., N.W., Washington, D.C. 20036.

Tips on working with plastic plumbing pipe



Take a look at the accompanying photos. One shows a setup for cutting plastic pipe off square if you don't have a miter box. The jig consists of two boards, the small one tacked across the other at 90 degrees. The straight edge of the larger board then provides a line-of-sight guide to a square cut as you press the pipe against the crosspiece. Use a fine-tooth saw. If it's a hacksaw, insert the blade to cut on the forward stroke and apply a little downward pressure. Scrape off burrs from the cut end.

The tip comes from a do-it-yourself brochure on working with CPVC (chlorinated polyvinyl chloride) plastic pipe, available at most Sears stores or through the company's catalog. Plastic pipe offers an easy way to add to home plumbing, if your local code permits its use. Better ask first.

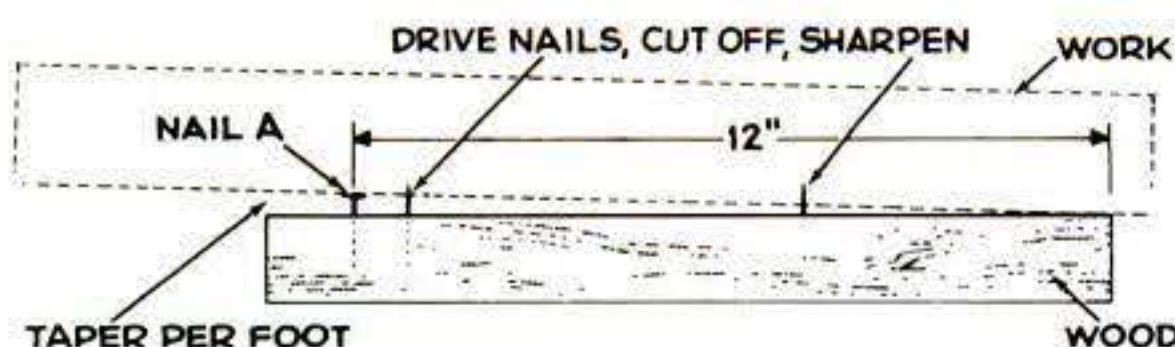


As the second photo suggests, you make watertight joints very easily—by applying plastic-pipe cement. First, use emery cloth or medium sandpaper to buff the pipe end that will slide into the connection. Apply cement with an artist's brush. Available adapters make it possible to tie plastic plumbing into existing copper or iron piping. The Sears brochure explains how.

Those clever problem solvers—our readers

When something needs doing in a better way, I'll always put my money on the ingenious people who read POPULAR SCIENCE to come up with sensible suggestions. Some recent examples:

When you're laying bricks or blocks, David Cunningham of Blacksburg, Va., suggests putting down bottle caps on each successive row to keep the rows even. Let them remain in the mortar . . . Joshua Hutchins' mother provided the solution when there was no room for him to keep his shiny new bike in the family's garage in El Granada, Calif. She sewed lead weights into the edges of a large plastic cover that Josh drapes over the bike outdoors . . . To clean a barbecue grill, John C. Sommer of Saginaw, Mich., puts it in a watertight plastic garbage-can liner along with a detergent solution, and lets it soak . . . For cutting wedges of different tapers and lengths on his table saw, W. E. Tritz of Waukesha, Wis., devised the gauge shown in the drawing below. Taper per foot is determined by the amount that Nail A projects from a wood block that has parallel sides. The taper is used by pressing the workpiece against the sharpened nails until the desired taper is obtained,



then sliding the gauge piece along the saw fence as the cut is made . . . Mark Goranson of Williston, Vt., suggests installing a slide-out bin in your glove compartment to make its contents more readily accessible.

Just born:
8-hp. of
workpower



New 8-hp. model shown with 36-inch mower, also available with 42-inch front blade. Also available: 12- and 14-hp. models with a range of attachments.

The nifty new garden tractor that's a lot like a sports car—and strong as a brute.

New Holland brings you that great sports-car feeling in a great new 8-hp. compact garden tractor and it's every bit as exciting as it sounds!

The sports-car flair starts with a deluxe, contour driver's seat. Slip into it. The first thing you'll notice is all the knee-room. You won't find a lot of handles and knobs poking at you, either. At your right hand is the one simple lever controlling forward, reverse, stopping. (Driving is really fun, just as it is in a sports car!)

Now step down, stand back and look at the

sporty slant of the front hood and start thinking about the envious glances you'll get from your neighbors when you ride out on your New Holland.

So much for the outside. Happily, New Holland's beauty is more than skin-deep. The frame is in the "heavy-duty" class. Either the hydrostatic or the mechanical transmission will give you peace of mind for many years. The engine is "counterbalanced" for smoother riding—and less strain on the whole machine.

There's lots more you'll like, too. The mower connected to the front axle. (Result: It follows the ground contour bet-

ter, won't scalp high spots or skip low spots.) The short turning radius. (Think about mowing into tight corners.) The quick-mount attachments (designed for do-it-yourselfers).

The fact is, New Holland learned a lot about building rugged machines on the way to becoming the country's #1 manufacturer of specialized farm equipment.

However, the only way you'll know it all is to see it at your New Holland dealer's.

But be forewarned: Once you get your hands on this beauty, you won't want to settle for any other.

Early Bird Special: Buy now and get a gift (or two)!

EITHER this handsome General Electric 12" black-and-white portable TV with FM sound from front speaker.



Everyone who buys a New Holland garden tractor (any new model: 8-hp., 12-hp., 14-hp.) between March 1 and April 30, 1972 will receive one or more of these bonus gifts with his purchase.

...OR ANY TWO

of these around-the-house work-savers.



Black & Decker electric lawn edger-trimmer with powerful 1/2 hp. motor

Meinor 2-speed traveling lawn sprinkler—that shuts off automatically

Black & Decker 3/4" deluxe variable-speed and reversing power drill

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Gravity provides water pressure for "tower." Container collapses to roof as it empties.

Put a Water Tower on Your RV

Does your RV have a separate faucet for a campsite hookup? It does? What happens at campgrounds that don't have water outlets? You use the hand pump. But for less than six bucks, you can have running water from a "water tower" that sets up or knocks down in two minutes. All you need is a five-gallon collapsible plastic container, a short length of hose, a clamp, and some fittings.

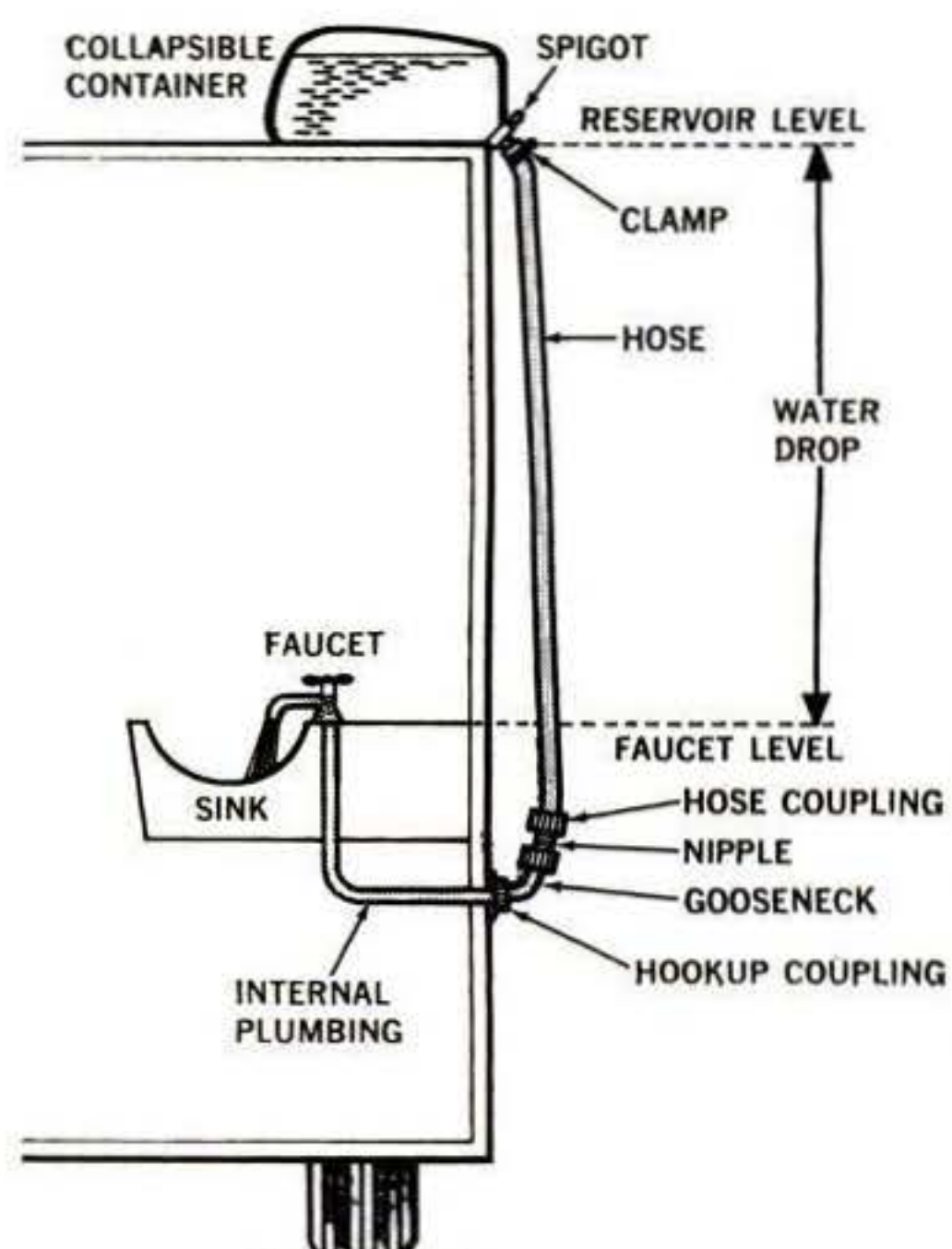
The water container must be the *collapsible* type—a rigid one won't work. Most hardware stores have the other items you'll need. A 6' length of washing-machine hose without a coupling at one end will do the trick. Make sure the noncoupled end will fit over the spout of the water container— $\frac{5}{8}$ " inside diameter should do it. Use an adjustable clamp to keep the hose on the spout.

Two fittings are needed. To connect the other end of the hose to the hookup coupling, you'll need a gooseneck and a 1" nipple to join gooseneck and hose. Because hose couplings and $\frac{3}{4}$ " pipe threads aren't the same size, put an extra rubber washer at each end of the nipple to prevent leaks. If you use 6' of the male end of a garden hose instead of washing-machine hose, you won't need a nipple.

Attach the hose to the water container and close the container's spigot before you put it on the roof. You can leave the hose permanently connected to the container spout. With the container on the roof, connect the other end to the RV hookup. Let some water flow from the hose to prime the system. Inspect for leaks, and you're set. If winds are strong, refill when you get down to one gallon to add weight.—Walter S. Andariese



Here's all you need: the container, hose, clamp, gooseneck, nipple. Just add water.



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To keep the sales momentum going, your Dodge Dealer can offer you a FREE automatic transmission. This offer is good on any specially equipped D100 V8 Sweptline pickup with a 131-inch wheelbase.

How about that for a deal? And the nice part about it is the fact you'd probably buy the equipment in the special package anyway.

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Bumper guards, front • Bright bumper, rear • Bright hubcaps • Two-tone paint • Bright drip rail moulding • Side Moulding Package • Sliding rear window • Tinted glass, all windows • Dual bright 5" x 7" outside

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Electronic Ignition System—a pickup exclusive from Dodge.

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*Based on Dodge pickup sales from Nov. 1 to Dec. 31, 1971.

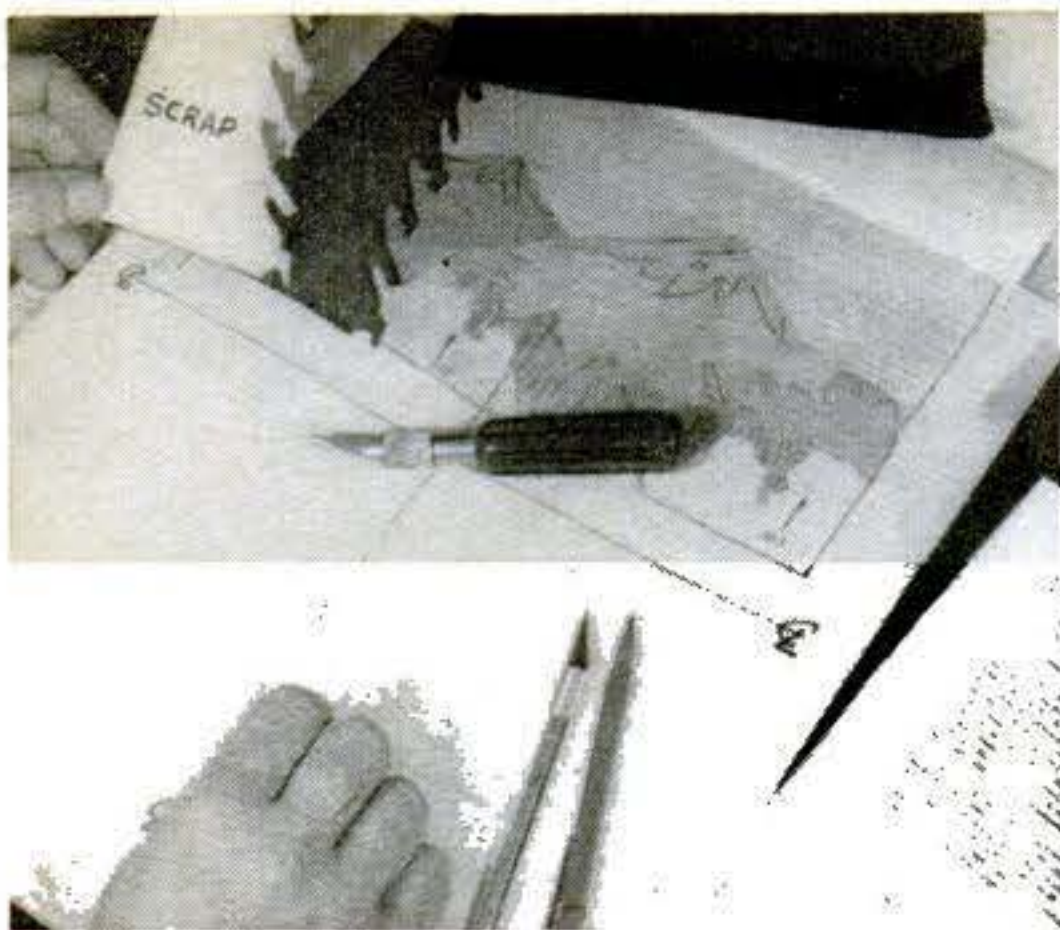
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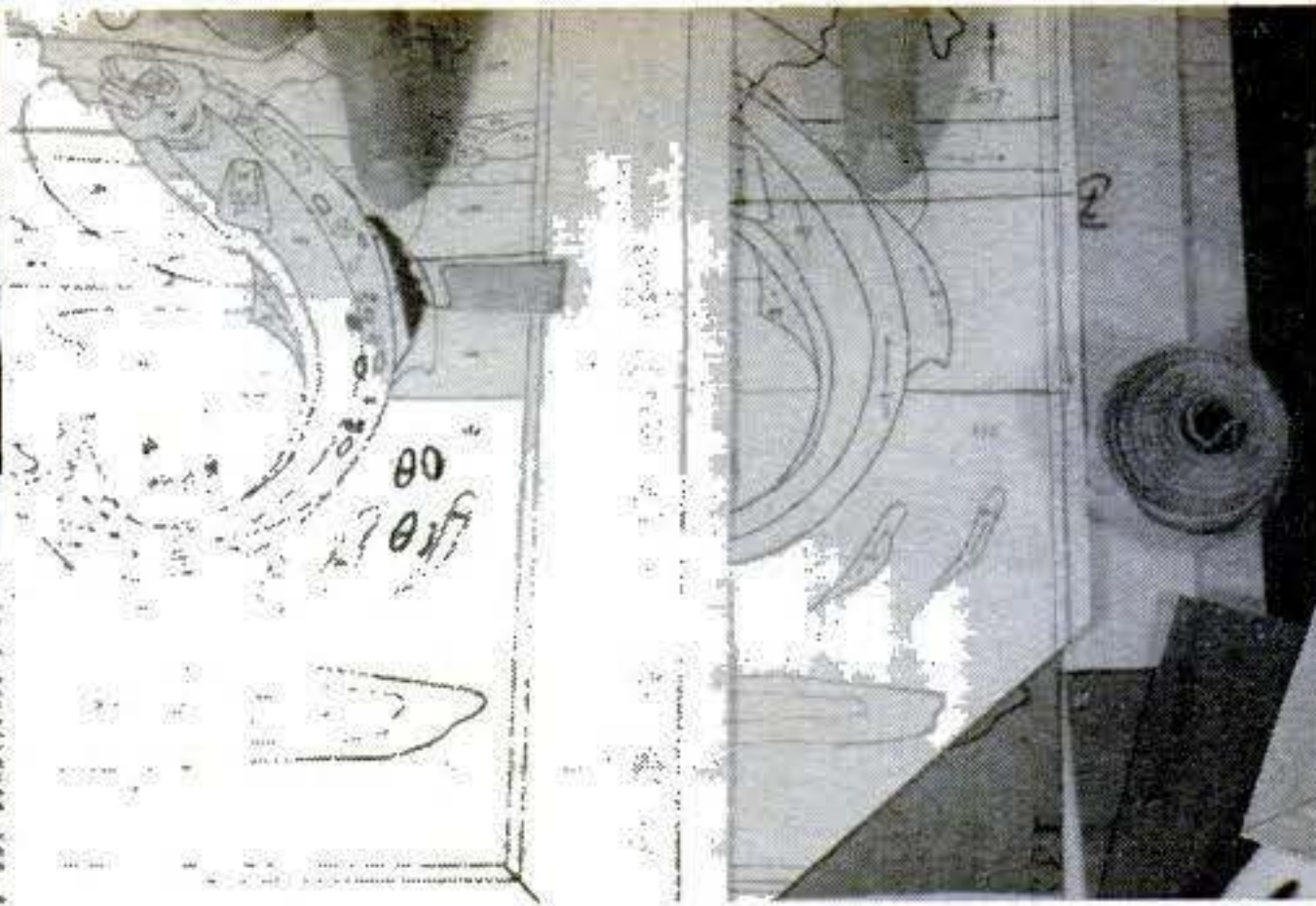


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Scrap veneer sheet, with pattern traced on it and cut out, serves as template for cutting veneer pieces that make up picture.



"Masterpiece" pattern at left has more details than simplified pattern (right). Additional details, shadings, and refinements can be added at the end.



PERSONAL-USE REPORT: New Veneer Kits Make Marquetry Easy

Marquetry, the centuries-old art of inlaying wood veneers, has gone modern. Two things are new: First, the veneer is thinner— $\frac{1}{40}$ " instead of $\frac{1}{32}$ "—so you can easily cut it with a sharp hobby knife. Second, the kits include two design-tracing patterns—a simplified pattern and a more complex "masterpiece" pattern.

Here's how you do it. Starting with the sky, you hinge-tape the pattern over a picture-sized sheet of "waste"

veneer and, element by element, trace the major parts of the picture. Carefully following the traced outline, cut an opening or "window" in the waste veneer. Next, temporarily tape the proper veneer under the opening and cut around the contour, using the opening as a template. The piece will fit exactly. Tape it into the opening from the front side (all tracing and cutting is done from the back side—patterns are reversed). Continue

tracing and cutting until the picture parts are in. Details can be added by cutting additional windows. Degree of artistry is up to you.

Finally, you trim the edges, apply the border, glue the picture to the backing board, sand, fill, and coat it.

Prices are \$5.95 to \$9.95. Thirty-five different inlaid wood picture kits are available from A. Constantine & Sons, 2050 Eastchester Rd., Bronx, N.Y. 10461—Phil McCafferty

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Richard Hiddleston
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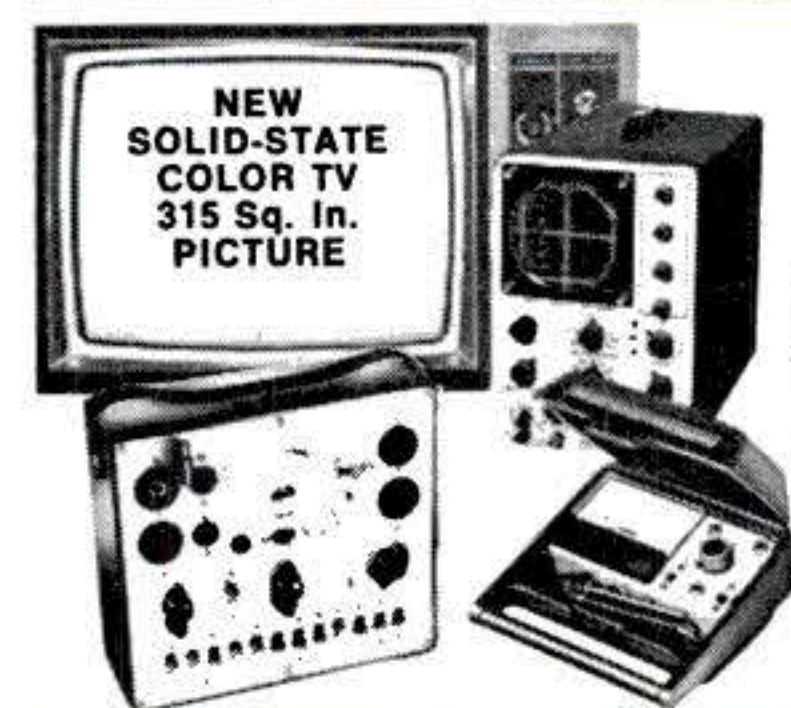
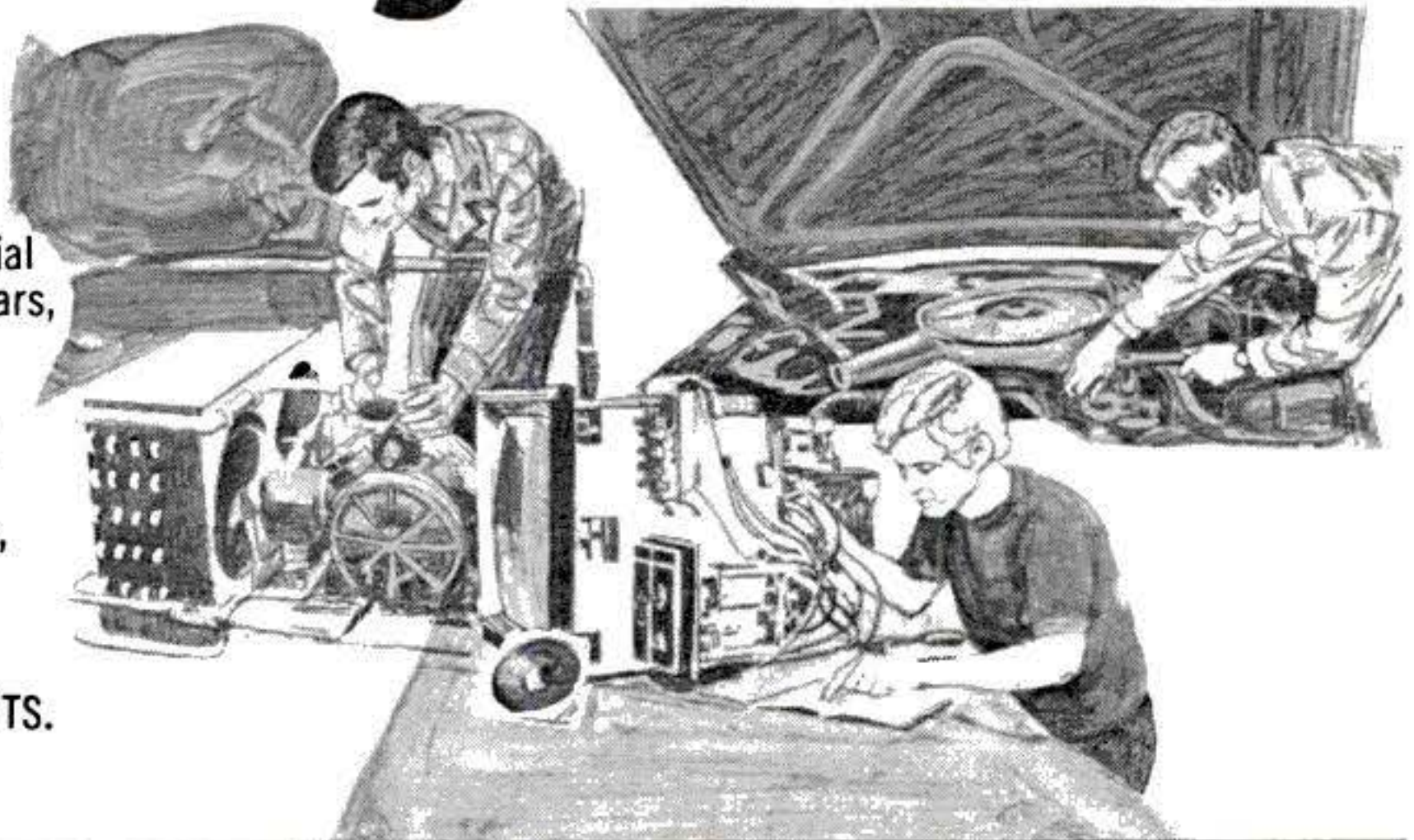
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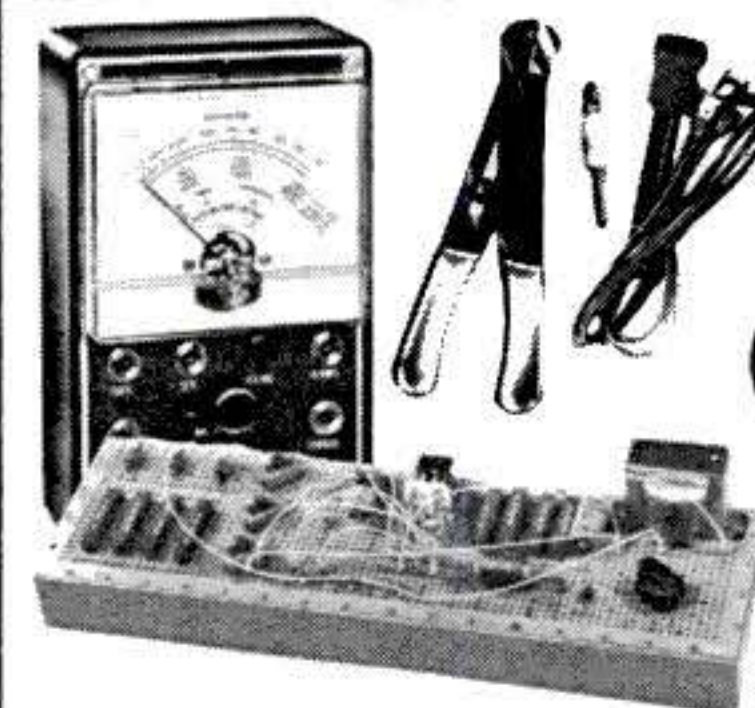
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How to Work with Green Wood

Treat it right and it cuts, carves, and shapes like no wood you've ever worked

By KAREN LEE MAGNUSON

Ever wish you could hack a nice burl or crotch out of a green log and turn it into a fine shop project without the usual problems of shrinkage and cracking you run into?

You can—if you know how to treat the wood. The secret is soaking in a water solution of polyethylene glycol 1000 (PEG). PEG is a waxlike chemical closely related to antifreeze. During the soak it penetrates the green wood and locks into the fibers. Later, when you dry the wood, the PEG remains in the fibers, preventing shrinkage and consequent cracking.

Researchers at the Forest Products Laboratory in Madison, Wisc., have found it reduces shrinkage to less than the thermal expansion of many plastics. So even those notoriously un-



Turned from green wood, these PEG-treated bowls are crack-free. Finish is Danish Oil.

stable—but beautifully-figured—burls, butts, and crotches can be preserved without a crack.

How to use it. First, dissolve the PEG in hot water. Don't heat PEG

directly—it may catch fire. Normal dilutions are one to one, or one to two.

It's easiest to store the solutions in glass or plastic soaking containers. Don't use metal—it can discolor the wood during a soak. Plastic garbage cans work well for large projects. To prevent mold and fungus growths, add borax to the mixture. A one or two percent concentration does the trick.

Soaking times vary with the size and species of the wood, the temperature and concentration of the solution. The table at the end of this article shows typical times for walnut. With softer, more porous woods, you can get by with about half the soaking time.

For thorough, even penetration, use weights (not metal) to hold the wood down into the solution. Support individual blocks on thin strips of wood to allow the PEG to circulate freely.

The treatment does little good on wood that's dry or partially dry. Blocks to be treated should be cut green. Then keep them in clean water until you're ready for processing.

After the soak, the wood must be dried. Air drying works, but takes a long time. A homemade kiln—a vented

[Continued]



Origin of a beautiful hunk of wood, a maple burl. Soaked in PEG, highly irregular burls can be dried without cracks.



Rough-cut or -turn your projects before soaking in vat to remove excess wood and shorten treatment times.

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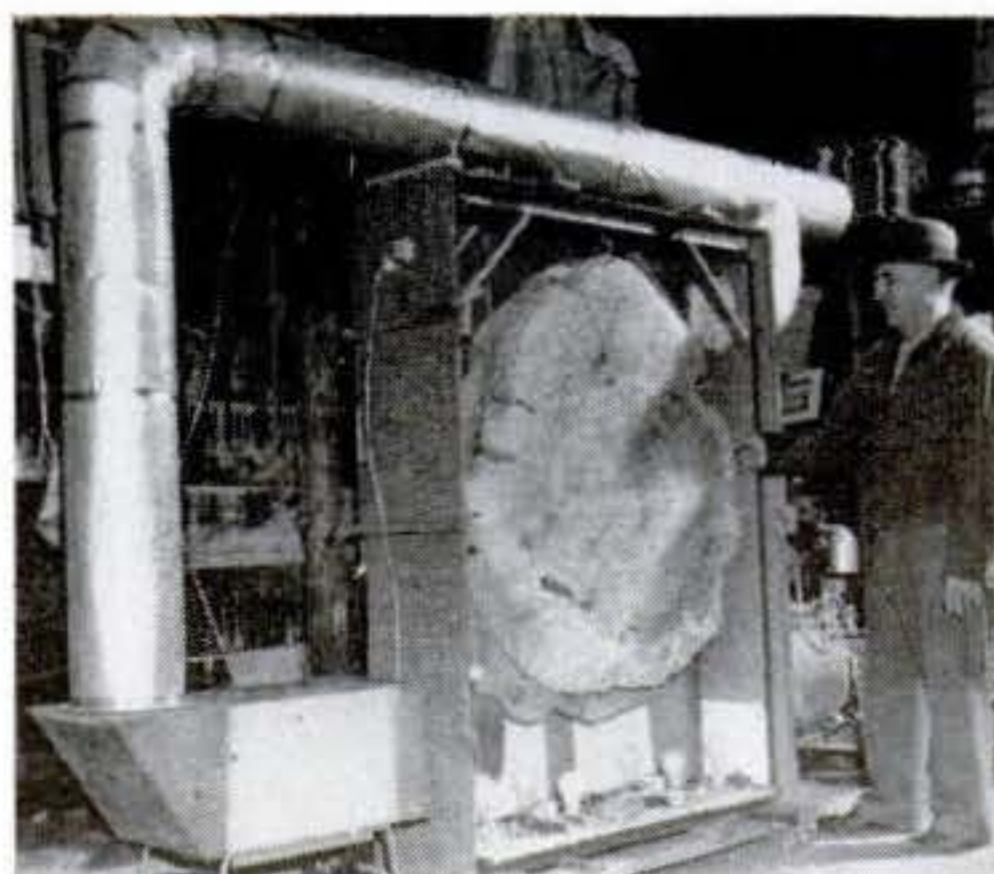
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How to Work with Green Wood

[Continued]



PEG-treated to intensify grain, this log section was bleached with dilute oxalic acid before finishing to enhance the color and bring out sap-heartwood contrast.



A homemade kiln made from scrap lumber uses light bulbs for heat (dehumidifier optional), and can cut after-soak drying time.



Like a slab of polished marble, this 38-inch cross section from a 784-year-old redwood dried plane and flaw-free after it was soaked in PEG and water.

wooden box warmed with a few light bulbs—speeds drying.

Working and finishing. PEG-treated wood is nice to work with. Ike Wynn, owner of a custom gunstock company, says it "cuts, carves, and shapes better than any wood I have worked with in my 20 years of stock making. Gluing the wood is no problem, either. White glues—Elmer's for instance—and hot-setting phenolics make the strongest joints.

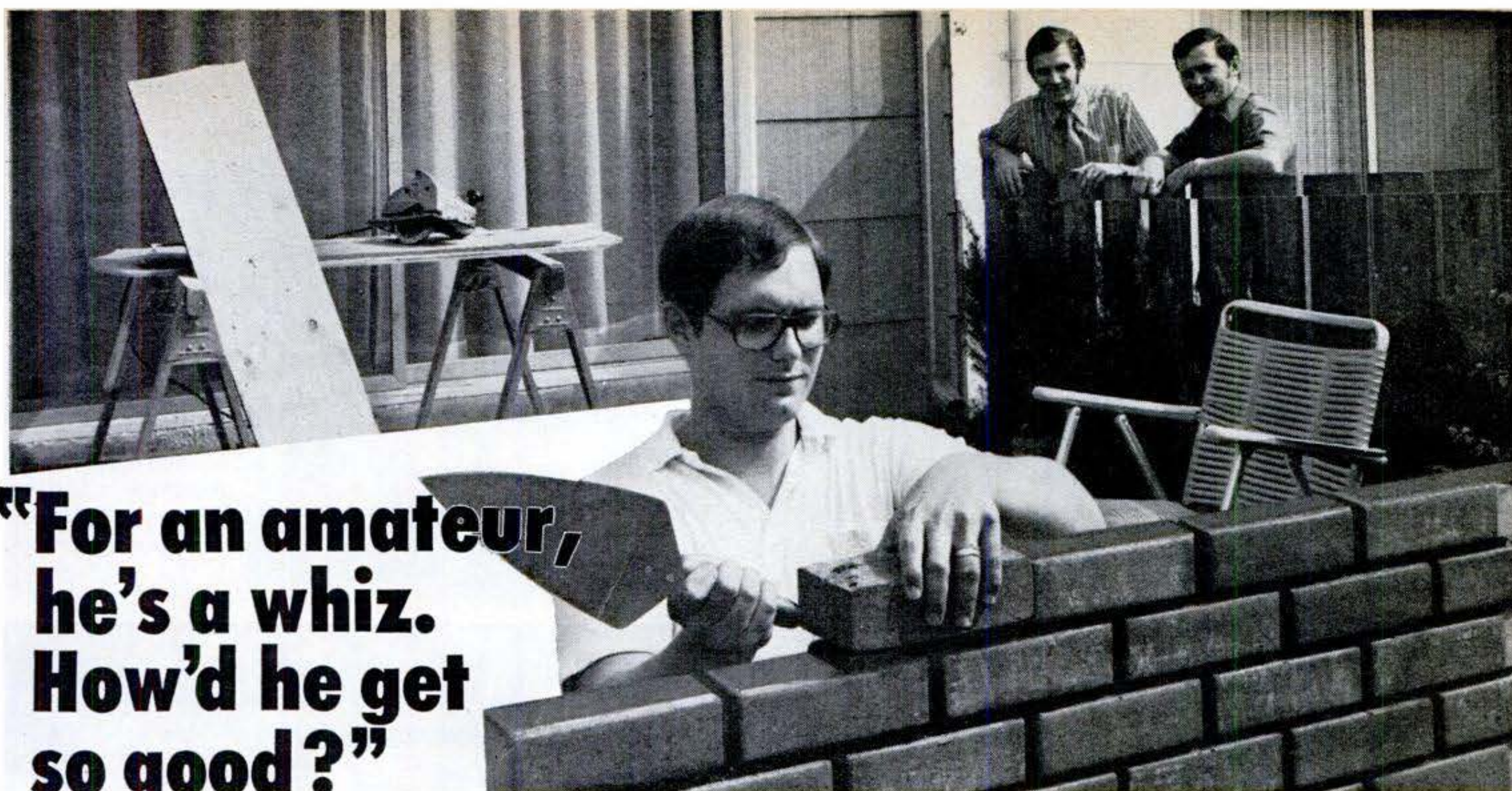
Before finishing, the Forest Products Lab recommends you smooth all surfaces with a jointer or coarse sandpaper. Then sponge the wood with warm water and sand twice with wet or-dry paper. First use 220 grit, the 320 or 400. Finishing is a little tricky. PEG won't take all normal finishes and may bleed through some in very humid weather. The two most successful are polyurethane varnish for a shiny, built-up finish, or a penetrating oil—Forest Products Lab recommends Watco Danish Oil—for a natural textured look.

Finishes dry slowly over PEG, so you may have to allow a day or more between coats if you use varnish. Danish Oil requires just one coat.

Where to get PEG. You can order from Union Carbide Corp., Chemicals and Plastics, 270 Park Ave., New York, N.Y. 10017. Minimum order is a gallon; price is about \$8.15 a gallon plus shipping.

TYPICAL TREATMENT TIMES FOR WALNUT

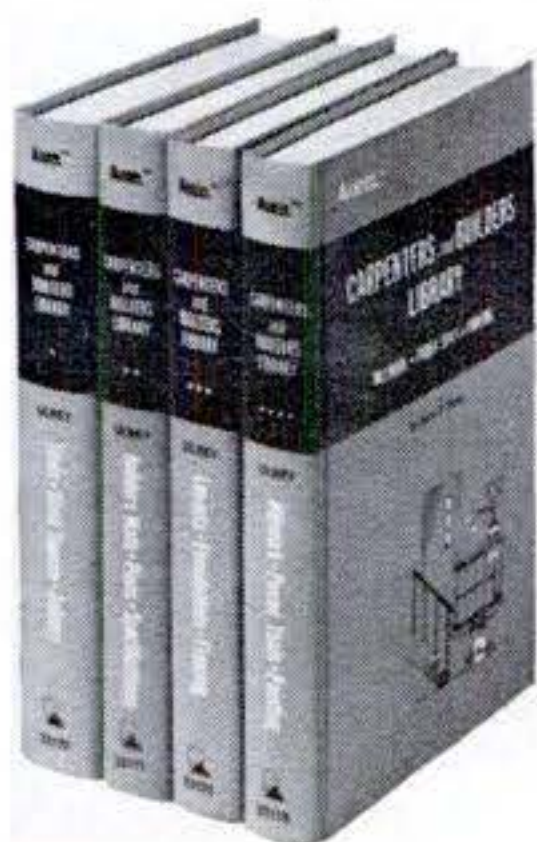
Solution concentration and temperature	Suggested soak for:	
	Disks up to 9 inches in diameter and 1 to 1½ inches thick	Disks over 9 inches in diameter and 2 to 3 inches thick
30 percent @ 70 degrees	20 days	60 days
50 percent @ 70 degrees	15 days	45 days
30 percent @ 140 degrees	7 days	30 days
50 percent @ 140 degrees	3 days	14 days



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he's a whiz.
How'd he get
so good?"**

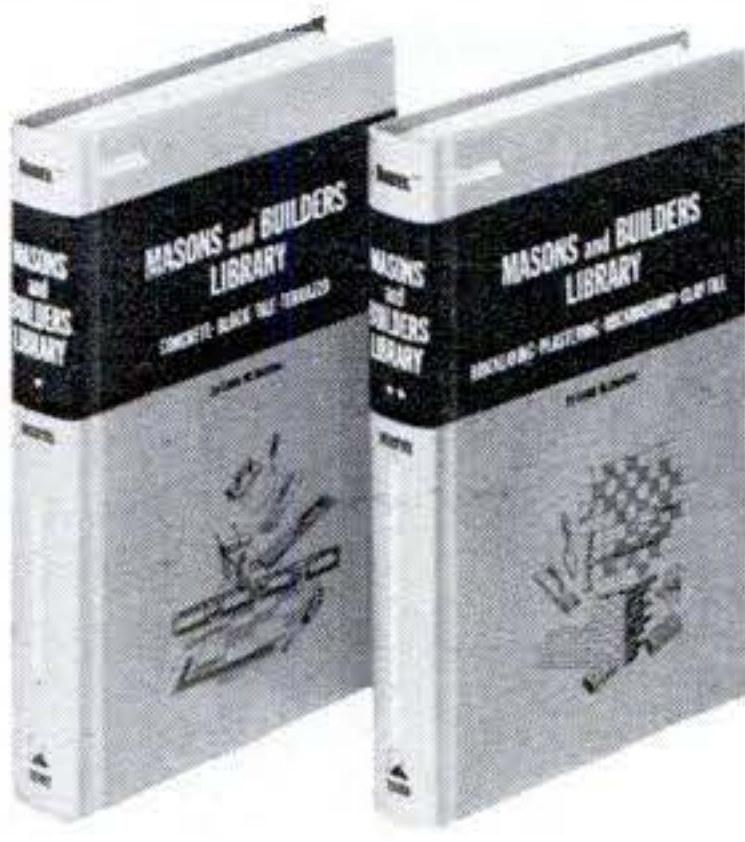
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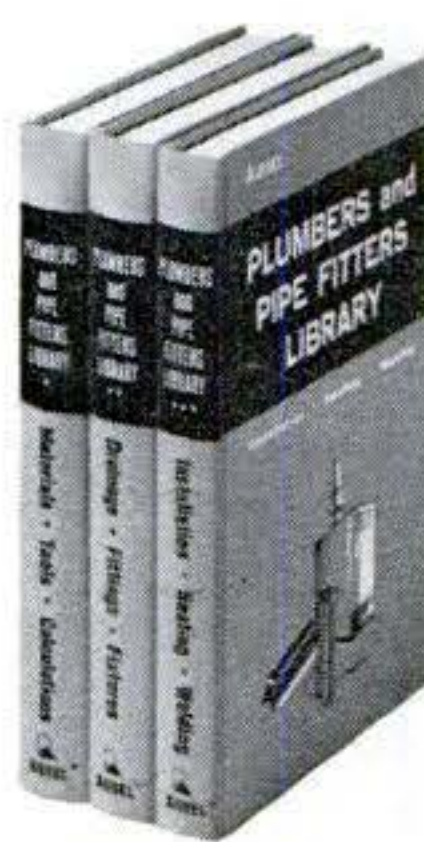
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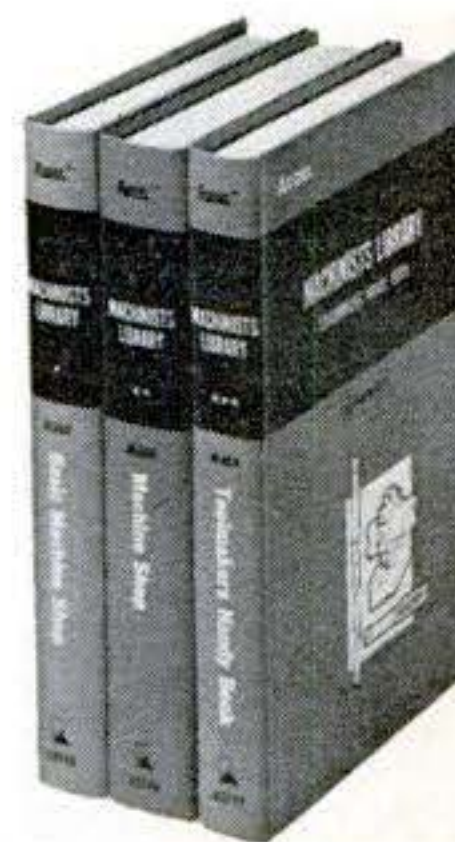
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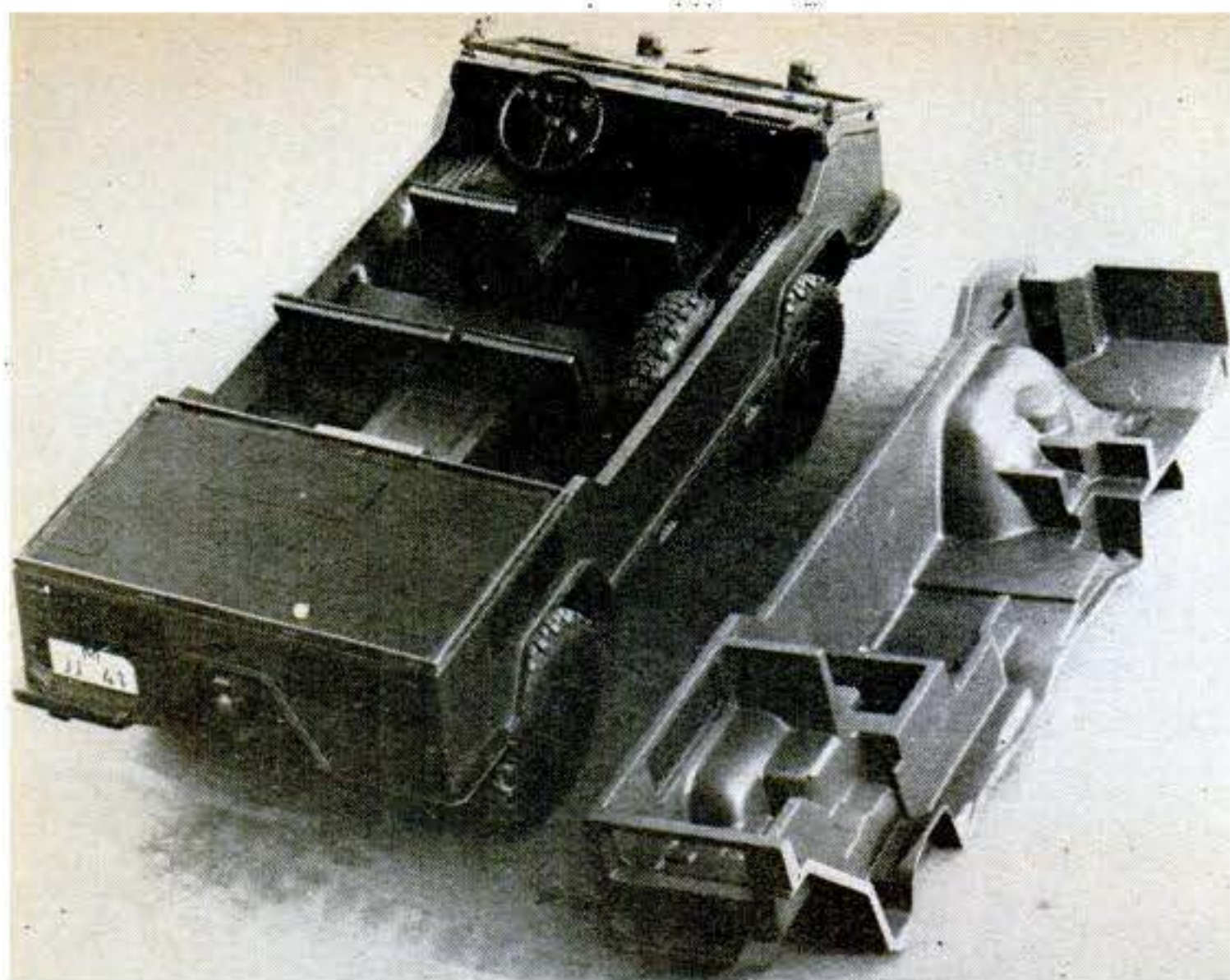
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Foam-filled fiberglass sandwich of amphibious body varies in thickness according to local load requirements. Entire body weighs just 430 pounds. At work in the rough (right), the light weight pays off in performance. Power is from BMW engine.



Amphibian floats high, even with four aboard. Marine propeller drives the truck in water, can be angled by a tiller for steering control.

No-Chassis Vehicles Go Plastic

Fiberglass and foam take the place of steel to cut weight and production costs

By DAVID SCOTT / PS European Editor

They were made in Germany—a pair of plastic trucks with no frames. Little toys from the workshop of Black Forest elves? Not at all. These are full-size prototypes from the engineering labs of Germany's largest aerospace group.

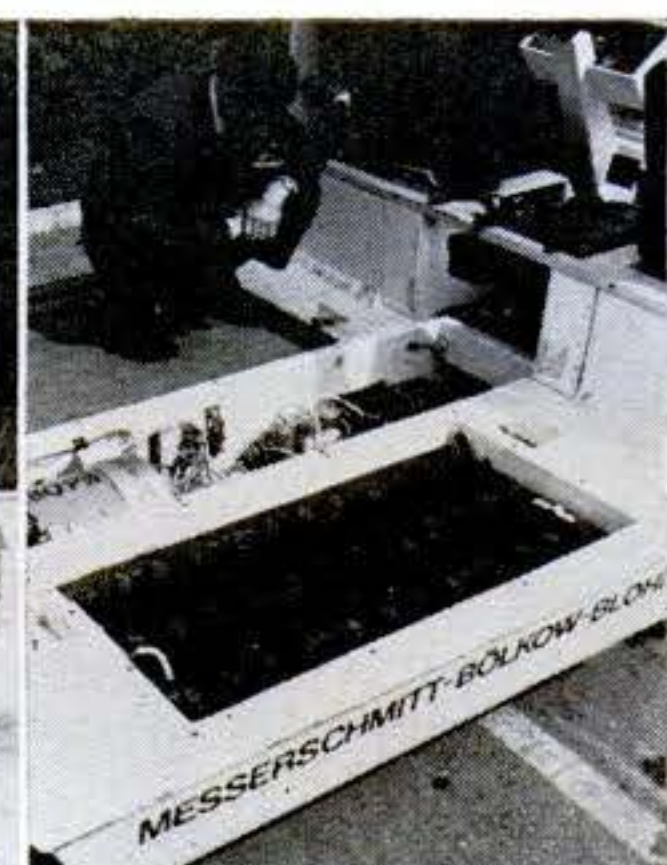
I went to Messerschmitt-Bölkow-Blohm's testing area in Bavaria to take a look at these trucks. I was especially interested in their plastic-sandwich construction. Plastic sandwiching for car or truck bodies is a combination of advanced chemical and forming techniques that can produce a unit so strong it can support itself—without a trace of reinforcing metal.

Here's how it works: Two thin outer skins of fiberglass are premolded to shape and sealed along the edges, then filled with liquefied polyurethane injected into the hollow space. This expands into a hard foam core. The result is a rigid structure that easily beats steel on weight and ease of repair when damaged. It has a long corrosion-free life and can be readily formed to meet any styling or installation need.

It is also uniquely adaptable for electric vehicles, as MBB's one-tonner demonstrates. Suitable for a truck, van, or small bus, this has a flat load



Author drives the electric and finds its acceleration silky smooth and braking superb. Vehicle can be adapted to a truck or small



bus, depending on body fitted to plastic body pan. Batteries live in box-like wells molded into floor between the axles.

platform only two feet off the ground.

The motor—a 44-kilowatt, 60-hp unit—is housed in a central channel, together with contactors and control equipment. These longitudinal depressions act like ribs or corrugations to increase chassis stiffness.

The really clever bit is the high-current wiring. The copper strips connecting batteries, contactors, and motor are integrated in the plastic assembly. These eliminate external cables, and insulation is good for 3,000 volts, if necessary.

MBB's 16-foot-long electro/transporter is heavy—close to 3½ tons, of which the lead-acid batteries account for nearly one ton. Still it has a 45-mph top speed, accelerates from zero to 30 mph in 12 seconds, and has a range of 60 miles.

But the company isn't aiming at battery-powered capability. It aims to show what can be done with fiberglass in sandwich construction. It sees the stressed-plastic monocoque body as a winner for auto manufacturers in small production volumes (up to 10,000 units a year). In these cases, tooling costs would be one-tenth that for steel.

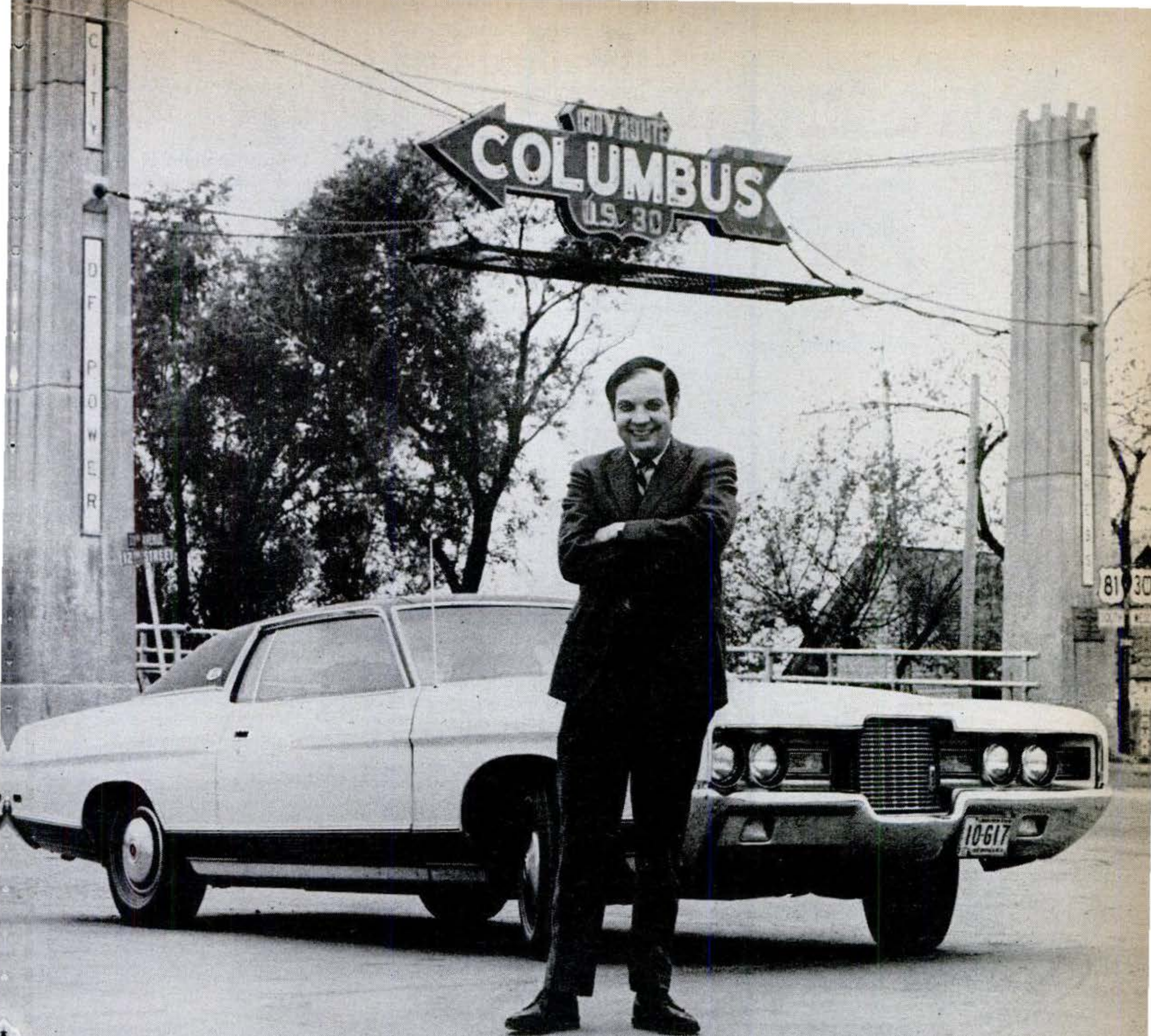
Cross-country amphibian. This is a very different variation on the same theme. Here there's a flotation body

that combines rigidity and light weight with buoyancy, and accounts for only 430 pounds of the 3,500-pound curb weight. The engine, transmission, fixed differentials, and steering gear are inside the hull, making waterproofing unnecessary.

Wheels, independently sprung on coils, are linked to the body at plates bolted to the sides of the molded wells housing the front and rear differentials. Swinging half-shafts are sealed by rubber bellows where they pass through the fiberglass walls, and these are the only mechanical parts that get wet when the car goes nautical.

Plastics shine in the wiring system of this vehicle, too. Inch-diameter tubes integrated in the body house the main harness, which is threaded through these conduits. The dashboard assembly (which has a molded-in washer bottle!) connects to the harness by four cables with multipin plugs fitting in terminal sockets on the adjacent body wall.

The 13-foot-long go-anywhere car has a top speed of 60 mph, and can climb 60-percent gradients, MBB claims. The German Ministry of Defense contributed to its development, but the machine is also seen as a natural for forestry, farm, and other cross-country work.



There's been a change in Power City.

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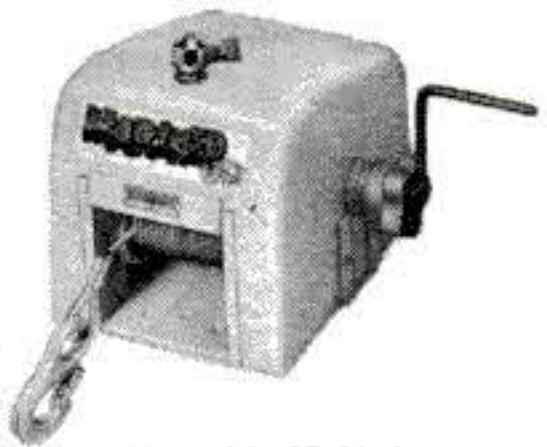
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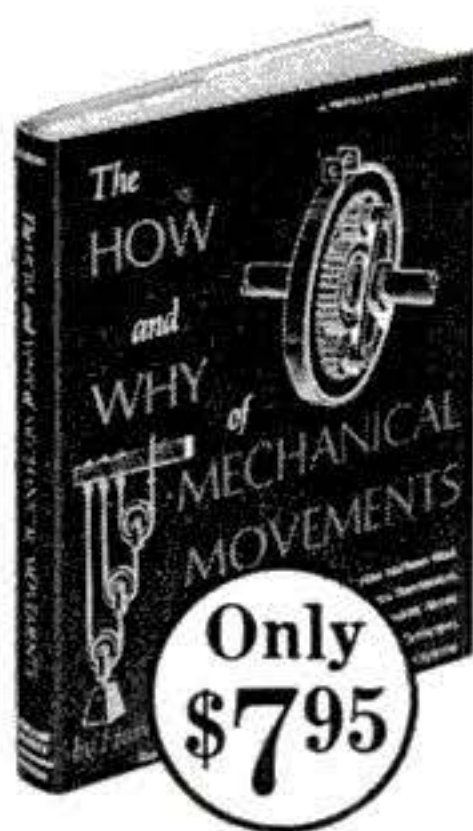
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OMC's Jet Kicks Off

[Continued from page 81]

up on plane at lower rpm. In one test, a pump with different blades dropped off plane at about 3,200-3,400 rpm, but the YJ kept the same boat on the plane at only 2,800 rpm.

One problem with jet drives has been the tendency to spin out at high speed, particularly if mounted on a boat with very little keel. To solve this problem, Jacuzzi has designed its jet units with a rudder out back under the jet discharge spout (see photos). In addition, the water intake forward on the boat's bottom was fitted with small twin keels.

Tests spared nothing. When I shoved the throttle forward, the engine with Corvette cam moved to high rpm almost at once. The action is very different compared to an engine rigged to a conventional propeller.

We tried every maneuver in the jet driver's book. First, long straight runs at high speed. The pump really likes it. Then a series of drag-strip-type takeoffs from a standing start: The jet digs in and sends you off with satisfying promptness.

You can have instant reverse. Even when running at speed (see photo) this is possible—because the impeller pump keeps going in the same direction. All that happens is that the gate drops down over the water discharge, deflecting it down and forward.

The boat and the jet unit displayed a great deal of integrity in high-speed turns of all kinds. Throttling down to a near idle, she still showed unusual response to the helm for a jet-driven rig. The small keels on either side of the water intake, and the rudder on the discharge unit did their jobs.

The OMC's impeller blades proved highly resistant to damage from the grit, sand, and small pebbles we ripped through when jumping a gravel bar repeatedly. She digested all with no signs of bad effects.

Of course, any jet can be clogged with marine vegetation. When this happens, the OMC jet has a handy access cap ready. It is secured by two bolts, and a tough steel bridging bar that serves a dual purpose: All you do is to pull two pins, and *presto!*—you have a wrench to disengage the bolts and remove the access plate. Then—with the engine off and the key in your pocket—you can reach in and clean off any accumulation.

One final maneuver: to back the jet-fired Cobra into a narrow stall under the slings. She backed in like a lady. The reversing flow of the jet pump gave us good speed control at idle and plenty of maneuverability to back in without touching.

Bicycle Camping

[Continued from page 97]

fun than the strait-jacket solitude mummy-type sleeping bag, and without the extra weight in most cases.

A rectangular bag is easier to adjust to changing temperatures, too. Zip it partway open if you get too hot; unzip it all the way and use it like a quilt if you need still more cool. Most mummy bags won't let you do this.

Once you decide which type you want, look through your camping catalogs and pick a bag with a temperature range that will suit your camp area.

Good buys: AYH sells some good basic down bags, adequate for summer camping, at around \$40. Eddie Bauer (Box 3700, Seattle, Wash. 98111) carries a fine four-way Ultralight for \$43.50.

Mattresses? Choose between air and foam. I like an air mattress. It's more compact, and it's fun for swimming. To save on weight, get a short length.

For the inner man. You can camp along without a stove for cooking, but the best weigh little, and save work at the end of a day when you're tired. Standard is the little brass Svea stove made in Sweden. It burns white gas or leaded gas—fill up at any gas station on your route—and runs about 45 minutes on a filling.

You can buy it with a cup-size pot that serves as a cover for travel (about \$12). The single pot is all you'll need for freeze-dried cooking (more on that in a minute) but you can also get it with a set of neat little nesting utensils, too, for \$18.50 from Bean's. In any case, get the aluminum fuel bottle.

You have two choices on food. Carry along freeze-dried stuff or buy up the real thing at stores as you travel. Dried foods give you independence, fresh foods give you more enjoyment, and cost much less.

Go forearmed. Look at the list of bike tools and equipment on page 153. Don't leave this stuff out or you run the risk of walking your bike back home. The other checklist is a route guide. You can add to or subtract from it as you see fit.

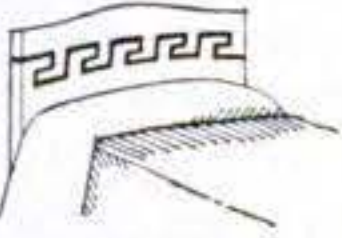
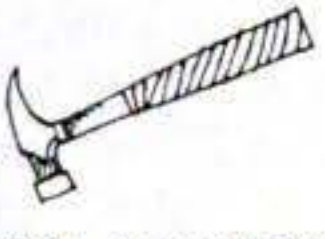
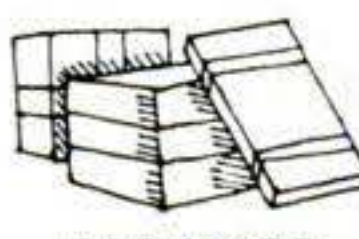
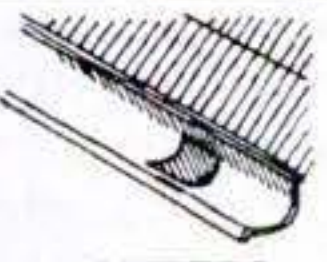
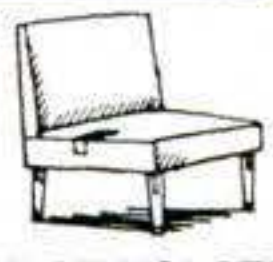
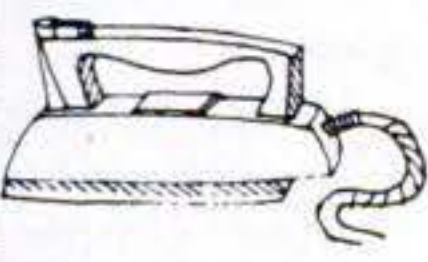
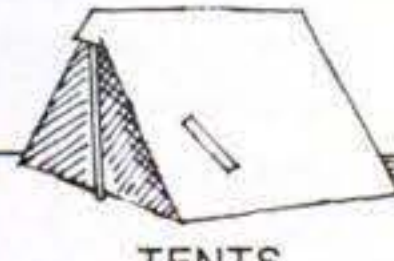
Make your own list of personal gear by deciding what you like to wear, how often you like to change it, and how much civilization you can leave behind without being uncomfortable.

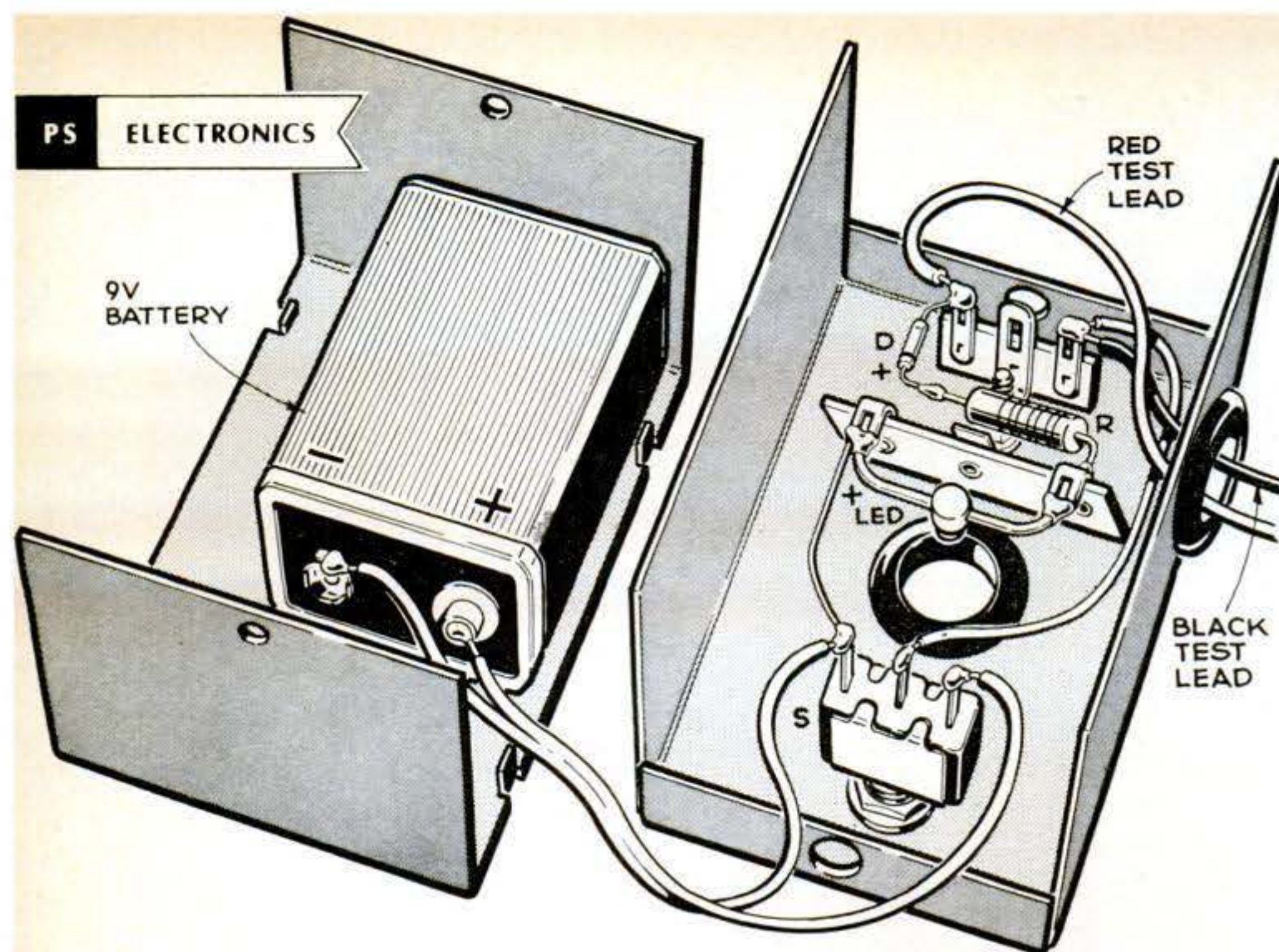
More information. A thorough treatment of bike camping would take a book. Happily, the first such book ever published comes out this month. It's *Two Wheel Travel*, price \$3, from Two Wheel Travel, Deacon W. New Canaan, Conn. 06840.

YOUR MYSTIK TAPE

"WHERE, WHAT AND WHY"

GUIDE.

WHERE	WHAT	WHY	WHERE	WHAT	WHY
 DECORATING	Mystik® Colored Plastic-Coated Cloth Tape	18 colors available. Won't stretch. It's washable.	 BOOK BINDINGS	Mystik Book Tape	Re-back a book. 11 colors available. 2, 3 and 4 inch widths.
 LUGGAGE	Mystik Colored Plastic or Cloth Tape	Great for long-lasting easy identification.	 SHOWER CURTAINS	Mysti-Kleer® Plastic Tape	It's tear resistant, waterproof, and shrinkproof.
 PAINTING	Mystik Masking Tape	Makes sure you get straight lines. Protects windows, baseboards and trim corners.	 AIR CONDITIONERS	Mystik Duct Tape	It's air tight. And great for sealing ducts, vents, blowers, too.
 TOOL HANDLES	Mystik Colored Cloth Tape	Makes non-slip grips and easy identifiers for hammers, chisels and files.	 PACKAGES	Mystik Package Sealing Tape	High tensile strength. Self-stick, easy application.
 GUTTERS	Mystik Aluminum Tape	Patch leaks. Won't rust. Works indoors or out.	 VINYL UPHOLSTERY	Mystik Clear Plastic Tape	It's tear resistant, won't yellow or dry out.
 RUGS	Mystik Carpet Tape	Takes the slipping out of scatter rugs. Holds down carpet tiles because it's double-faced.	 DOOR & WINDOW FRAMES	Mystik Sponge Tape	The high density tape that cushions and insulates.
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 TENTS	Mystik Fabric Tape	It's extra strong and waterproof. Try it on tears in window shades, awnings, tarpaulins.			
 PLASTIC POOLS & GARDEN HOSES	Mystik Colored Plastic Tape	Flexible. Comes in 18 colors. Tear and water resistant. Conforms to irregular surfaces.			
 HEAVY CARTONS	Mystik Strapping Tape	It's reinforced in two directions, can be used for strapping pipes and lumber.			



For car, boat, and home LED Wiring Tester

**Tiny light-emitting diode
glows bright red for
voltage and continuity tests**

Here's a matchbox-size gadget that can do a giant-size job of troubleshooting on car and boat electrical-wiring systems. It can:

- Determine the polarity of the system (negative or positive ground), be it a six-volt or 12-volt system.
- Check for presence or absence of direct-current voltage at a connector or terminal.
- Test electrical continuity of a cable, wire, fuse, bulb, or switch.

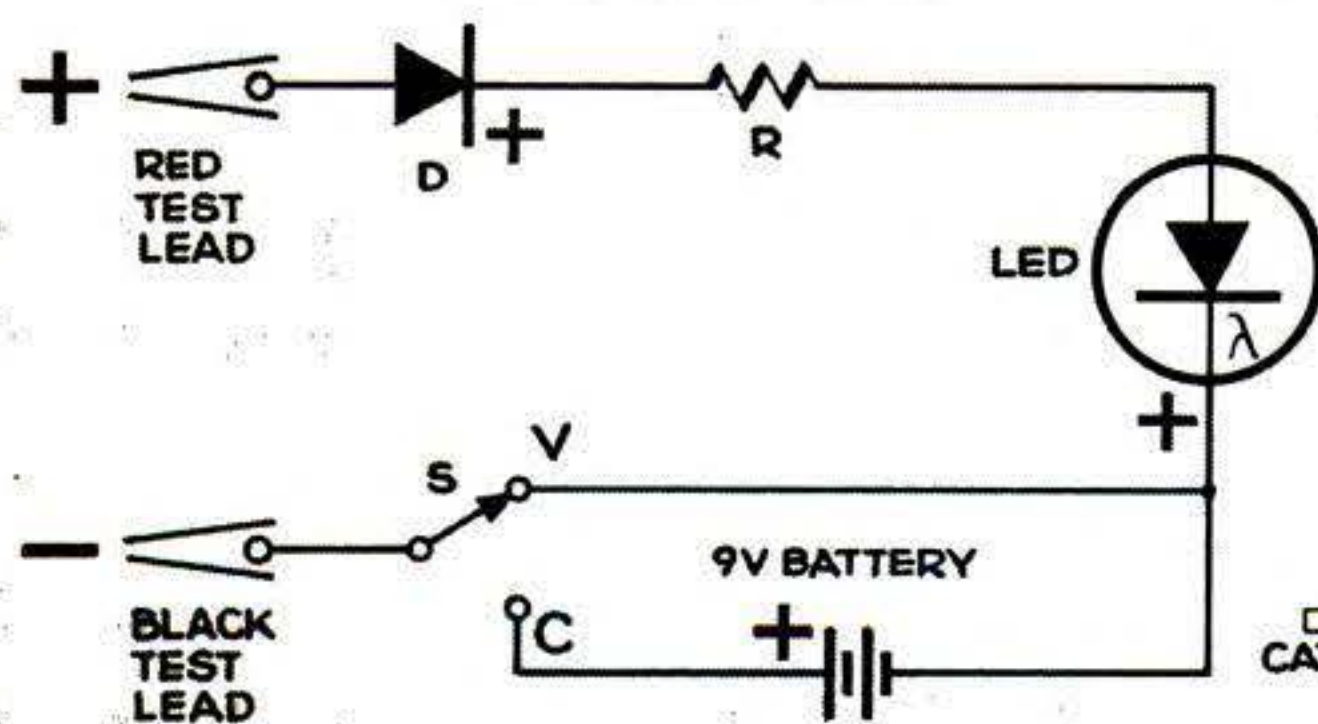
Heart of the tester is a tiny light-emitting diode (LED) that glows with brilliant red light whenever direct current passes through it. The LED specified in the parts list can be ordered from the Monsanto Co., Hobby Program, 10131 Bubb Rd., Cupertino, Calif. 95014, for \$2.30.

When toggle switch S is flipped to the "V" (for Voltage) position, the LED is placed in a simple series circuit along with silicon diode D and resistor R. This circuit can check voltage polarity and indicate the presence of a voltage.

The LED will light *only* if the positive (red) test lead is connected to the positive terminal of a voltage source, and the negative (black) test lead is connected to the negative terminal. The LED will not light if the leads are reversed.

Incidentally, the circuit will respond to any voltage higher than three volts. But, don't use the tester to check voltages higher than 15 volts or the LED may be damaged.

When switch S is flipped to "C" (for Continuity) position, a nine-volt battery is added to the circuit. Now, the LED will light whenever the test prods are electrically connected together—by anything that will conduct electricity.—Ronald M. Benrey



PARTS LIST

R—470-ohm, 1/2-w carbon resistor
D—1N914 silicon diode
LED—Monsanto MV-50 light-emitting diode (see text).
S—SPDT mini. toggle switch
2 1/4" x 1 1/2" x 1 1/8" chassis box, terminal strips, clip leads



Plastics That Replace Glass

[Continued from page 119]

particularly vinyl and Plexiglas, can be cut with tin snips. There are some fine points:

- Making straight cuts, it is quicker and neater to use the special "scratch-cutter" intended for plastics (see photo).

- The fine-tooth power-saw blade called a "plywood blade" is best for plastics—as for any thin material. It produces less "fly," is safer, cuts smoother edges.

- Saber saws cut the smoothest edges among portable electric saws. Bandsaws and jigsaws give an excellent smooth edge and can be used for straight cuts as well as curves.

- To plane an edge, set the tool for a shallow cut and make several passes. A low-angle block plane cuts best, although a standard smooth or fore plane works well.

- When an absolutely smooth edge is important, use sandpaper, and even a buffing wheel with compound.

- To assemble or combine plastics with other materials, the best adhesives are those labeled specifically for plastics. A water-soluble material, naturally, won't work.

- Using acrylic or other materials in actual glazing situations, a fine "glazing compound" is the silicone caulk material intended for bathtub sealing. Adhesion is excellent, and the permanent flexibility tolerates the tendency of plastic sheet materials to expand and contract.

- Be sure to cut plastic glazing with room for expansion at the edges.

Glazing with plastic. It is not always necessary to caulk-seal plastic glazing in place. For example, it is entirely possible and feasible to use a sheet as a storm window—without any frame or seal or holding device. The trick: Cut it to fit the insert opening; when winter comes, take off the screen, insert the plastic sheet, then put the screen over it. When you refasten the screen, it holds the simple, lightweight, unframed storm "sash" in place.

Glass sliding doors that open on a terrace or enclose showers are responsible for many serious home accidents. Plastic glazing eliminates this hazard. Used for basement windows, it prevents breakage from lawn-mower debris. Plastic air-conditioner window panels can reduce noise. Other window applications: garage, play-area porches, and jalousies. You'll find plastic sheeting useful for sliding cabinet doors and double-swinging cafe doors.

There are even shatterproof plastic mirrors—ending that old horror: "seven years of bad luck."

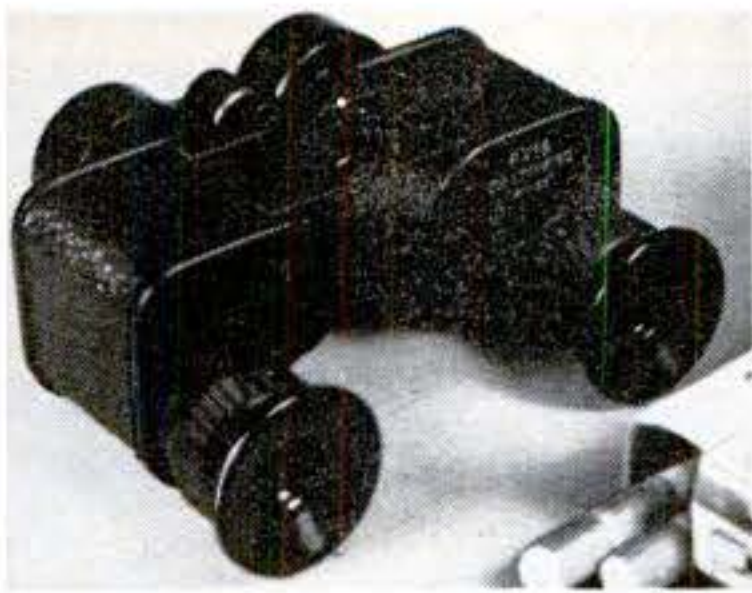
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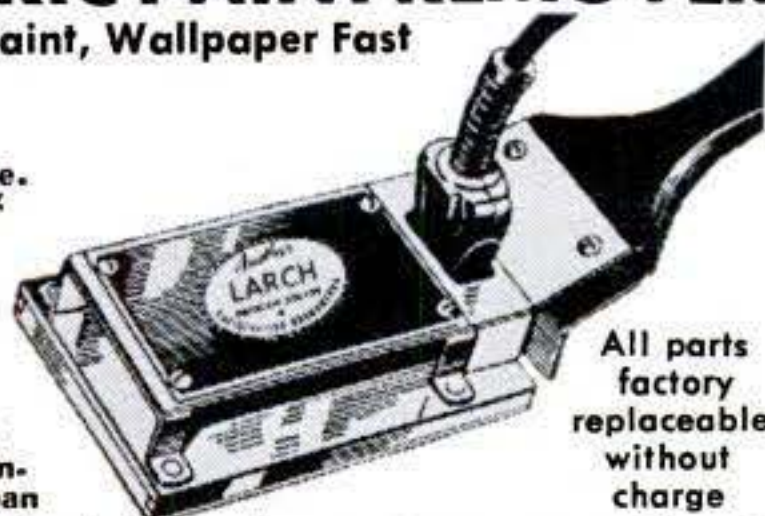
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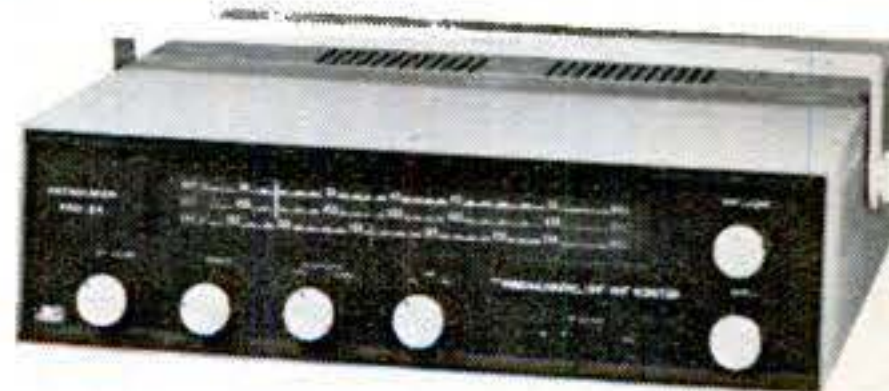
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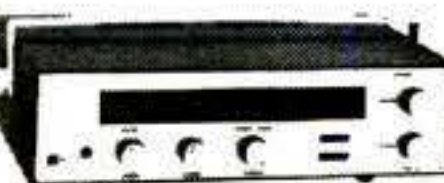
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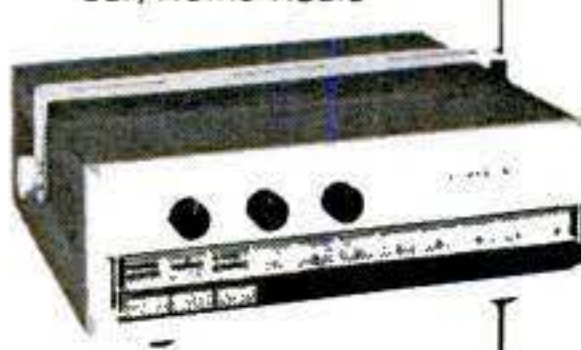
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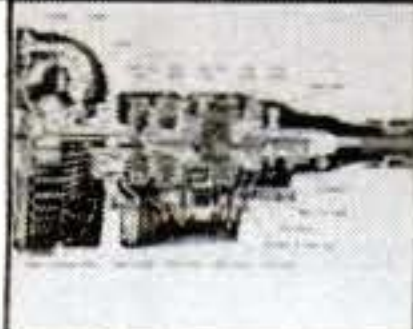
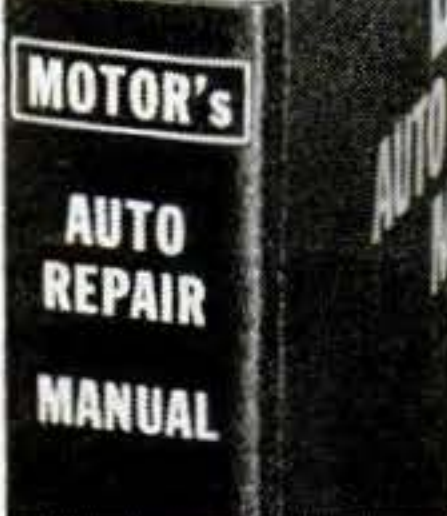
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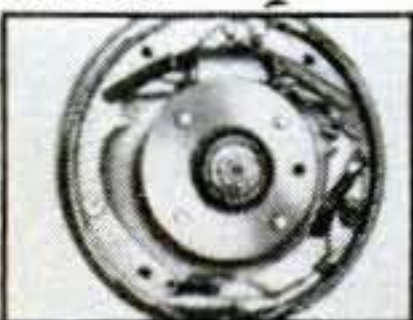
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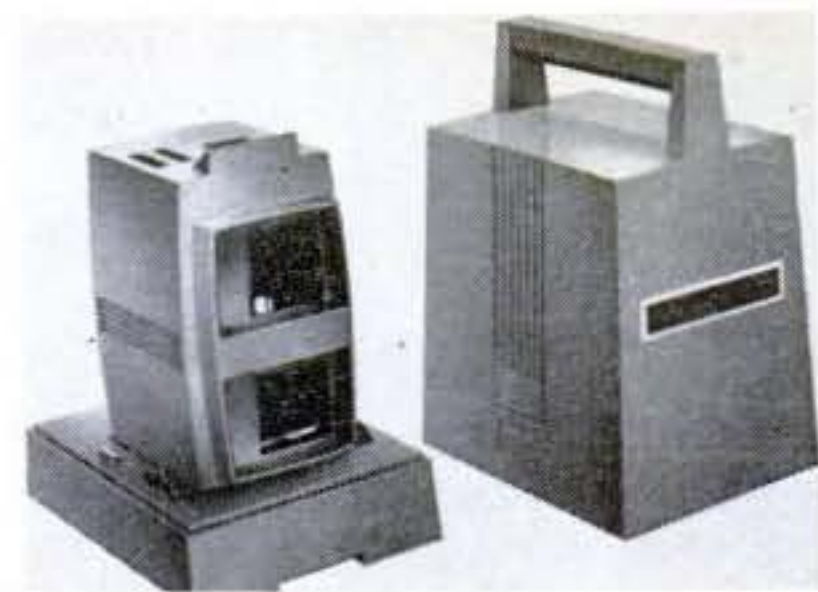
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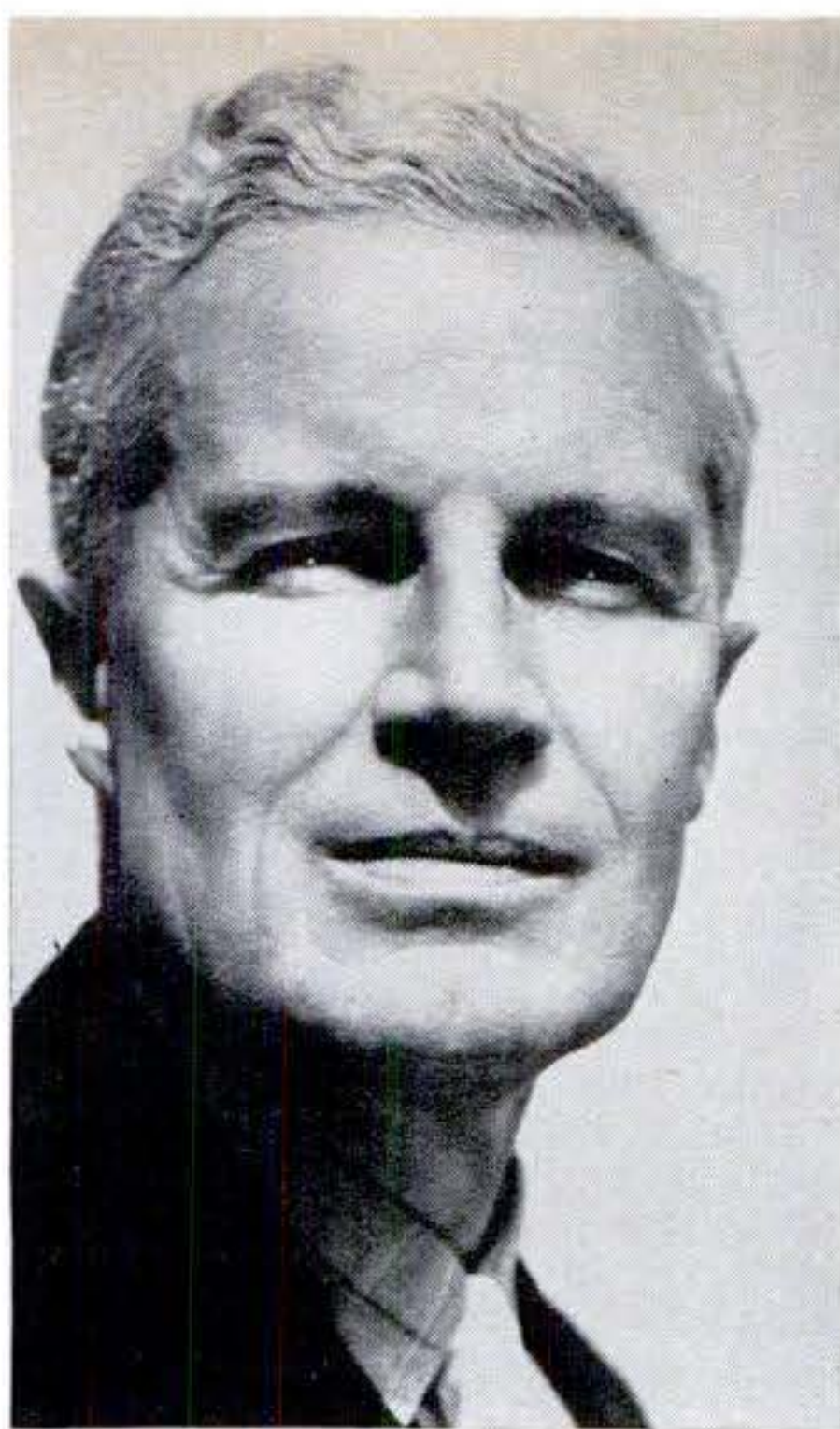


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summer home, my Cadillacs, my winter-long vacations and my sense of independence—behind all the wealth of cash and deep inner satisfaction that I enjoy—there is one simple secret. It is this secret that I would like to impart to you. If you are satisfied with a humdrum life of service to another master, turn this page now—read no more. If you are interested in a fuller life, free from bosses, free from worries, free from fears, read further. This message may be meant for you.

By Victor B. Mason

I am printing my message in a magazine. It may come to the attention of thousands of eyes. But of all those thousands, only a few will have the vision to understand. Many may read; but of a thousand only you may have the intuition, the sensitivity, to understand that what I am writing may be intended for you—may be the tide that shapes your destiny, which, taken at the crest, carries you to levels of independence beyond the dreams of avarice.

Don't misunderstand me. There is no mysticism in this. I am not speaking of occult things, of innumerable laws of nature that will sweep you to success without effort on your part. That sort of talk is *rubbish*! And anyone who tries to tell you that you can *think* your way to riches without effort is a false friend. I am too much of a realist for that. And I hope you are.

I hope you are the kind of man—if you have read this far—who knows that anything worthwhile has to be *earned*! I hope you have learned that there is no reward without effort. If you have learned this, then you may be ready to take the next step in the development of your karma—you may be ready to learn and use the secret I have to impart.

I Have All The Money I Need

In my own life I have gone beyond the need of money. I have it. I have gone beyond the need of gain. I have two businesses that pay me an income well above any amount I have need for. And, in addition, I have the satisfaction—the deep satisfaction—of knowing that I have put more than three hundred other men in businesses of their own. Since I have no need for money, the greatest satisfaction I get from life is sharing my secret of personal independence with others—seeing them achieve the same heights of happiness that have come into my own life.

Please don't misunderstand this statement. I am not a philanthropist. I believe that charity is something that no proud man will accept. I have never seen a man who was worth his salt who would accept something for nothing. I have never met a highly successful man whom the world respected who did not sacrifice something to

gain his position. And, unless you are willing to make at least half the effort, I'm not interested in giving you a "leg up" to the achievement of your goal. Frankly, I'm going to charge you something for the secret I give you. Not a lot—but enough to make me believe that you are a little above the fellows who merely "wish" for success and are not willing to sacrifice something to get it.

A Fascinating and Peculiar Business

I have a business that is peculiar—one of my businesses. The unusual thing about it is that it is needed in every little community throughout this country. But it is a business that will never be invaded by the "big fellows." It has to be handled on a local basis. No giant octopus can ever gobble up the whole thing. No big combine is ever going to destroy it. It is essentially a "one man" business that can be operated without outside help. It is a business that is good summer and winter. It is a business that is growing each year. And, it is a business that can be started on an investment so small that it is within the reach of anyone who has a television set. But it has nothing to do with television.

This business has another peculiarity. It can be started at home in spare time. No risk to present job. No risk to present income. And no need to let anyone else know you are "on your own." It can be run as a spare time business for extra money. Or, as it grows to the point where it is paying more than your present salary, it can be expanded into a full time business—overnight. It can give you a sense of personal independence that will free you forever from the fear of lay-off, loss of job, depressions, or economic reverses.

Are You Mechanically Inclined?

While the operation of this business is partly automatic, it won't run itself. If you are to use it as a stepping stone to independence, you must be able to work with your hands, use such tools as hammer and screw driver, and enjoy getting into a pair of blue jeans and rolling up your sleeves. But two hours a day of manual work will keep your "factory" running 24 hours turning out a product that has a steady and

ready sale in every community. A half dollar spent for raw materials can bring you six dollars in cash—six times a day.

In this message I'm not going to try to tell you the entire story. There is not enough space on this page. And, I am not going to ask you to spend a penny now to learn the secret. I'll send you all the information, free. If you are interested in becoming independent, in becoming your own boss, in knowing the sweet fruits of success as I know them, send me your name. That's all. Just your name. I won't ask you for a penny. I'll send you all the information about one of the most fascinating businesses you can imagine. With these facts, you will make your own investigation. You will check up on conditions in your neighborhood. You will weigh and analyze the whole proposition. Then, and then only, if you decide to take the next step, I'll allow you to invest \$15.00. And even then, if you decide that your fifteen dollars has been badly invested I'll return it to you. Don't hesitate to send your name. I have no salesmen. I will merely write you a long letter and send you complete facts about the business I have found to be so successful. After that, you make the decisions.

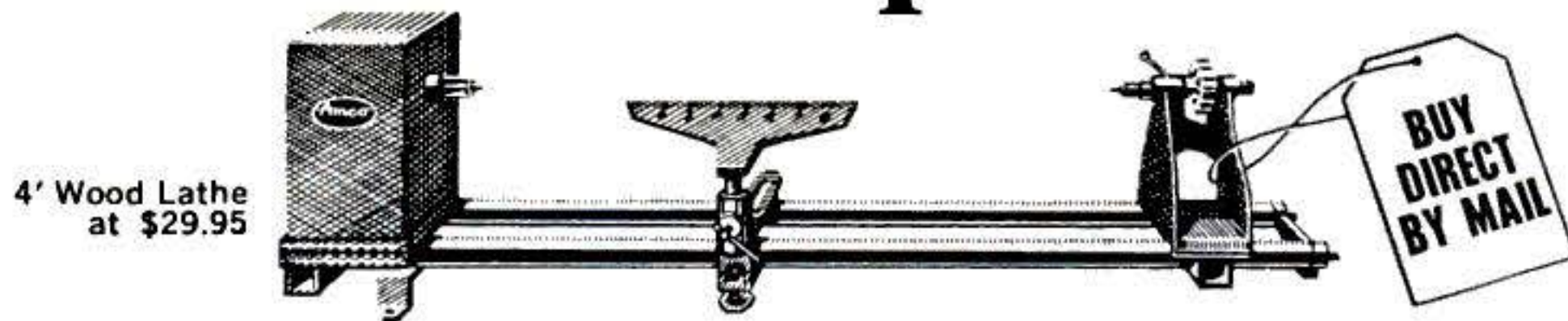
Does Happiness Hang on Your Decision?

Don't put this off. It may be a coincidence that you are reading these words right now. Or, it may be a matter that is more deeply connected with your destiny than either of us can say. There is only one thing certain: If you have read this far you are interested in the kind of independence I enjoy. And if that is true, then you must take the next step. No coupon on this advertisement. If you don't think enough of your future happiness and prosperity to write your name on a postcard and mail it to me, forget the whole thing. But if you think there is a destiny that shapes men's lives, send your name now. What I send you may convince you of the truth of this proverb. And what I send you will not cost a penny, now or at any other time.

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4' Wood Lathe
at \$29.95

They do the same job as tools costing up to 5 times as much.

We skipped the chrome to save you money . . . but we did not skip anything on performance. Actually, we skipped more than just chrome, we cut out every costly frill that wasn't absolutely needed.

The lathe shown above isn't exactly flashy. We admit it. But in a recent article, Popular Science used it to demonstrate wood lathe technique and said: "You won't go wrong with this economical introduction to wood turning." It is typical of our tools which in spite of low prices, are full scale and offer full performance and precision.

HERE'S HOW WE DO IT . . . First, we don't claim our tools should sell for five times the price! Just that our tools do the same job . . . with the same accuracy, ease and speed . . . and will last at least as long. AMT tools cost less to make and are sold direct. They are bona fide quality power tools used by serious amateurs and professionals alike and if sold in retail stores would be much higher in price. We use no magic, let's be specific:

SIMPLICITY . . . AMT tools are soundly engineered to eliminate every frill and gimmick—to minimize material and production costs. Machined parts are used only where they're needed. Unadorned cast iron and aluminum save you a fortune.

DIRECT-FROM-FACTORY SAVINGS . . . You save a bundle, yet, we offer a double guarantee backed by a 38-year-old company with millions of satisfied customers . . . and hundreds of orders pour in daily.

LARGE VOLUME . . . Our own foundry and large mass production facilities plus large buying power all work to keep costs down.

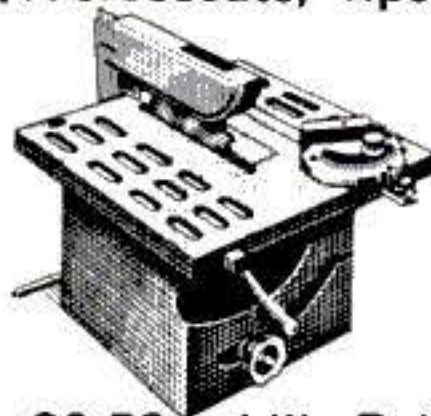
STANDARD PARTS . . . Our designs use standard hardware items wherever possible. By avoiding custom-made parts we pass on tremendous savings to you.

If you are looking for power tools that perform like units costing many times our low prices, order today and you'll be one step closer to many hours of woodworking satisfaction.

Bill Monty

POWER SAW 8" tilt arbor saw . . . crosscuts, rips,

mitres, cuts compound angles, dados, coves, moldings. Completely assembled with ground cast iron table, safety guard, splitter, mitre gauge. Less blade, motor. Rip fence for easier work alignment, \$3.50 add'l. Ball bearing model, \$5.00 add'l. Takes 1/3 h.p. motor or larger, standard blades, attachments. Wt. 26 lbs., f.o.b. factory



\$19.95



FREE OFFER, cabinet base plans, . . . with one piece of 3/4" plywood, convert your \$19.95 saw into a floor model with a huge 27" x 24" top. Takes cabinet rip fence, \$4.50 add'l.

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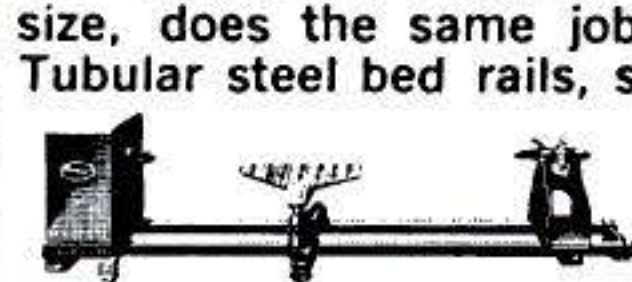
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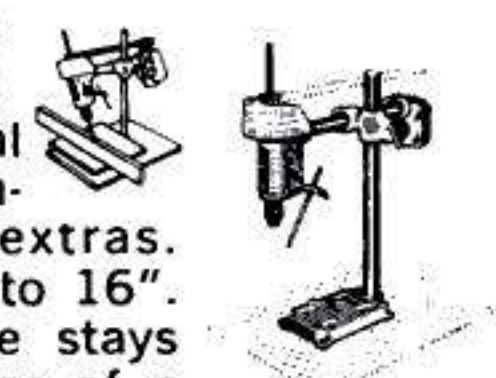
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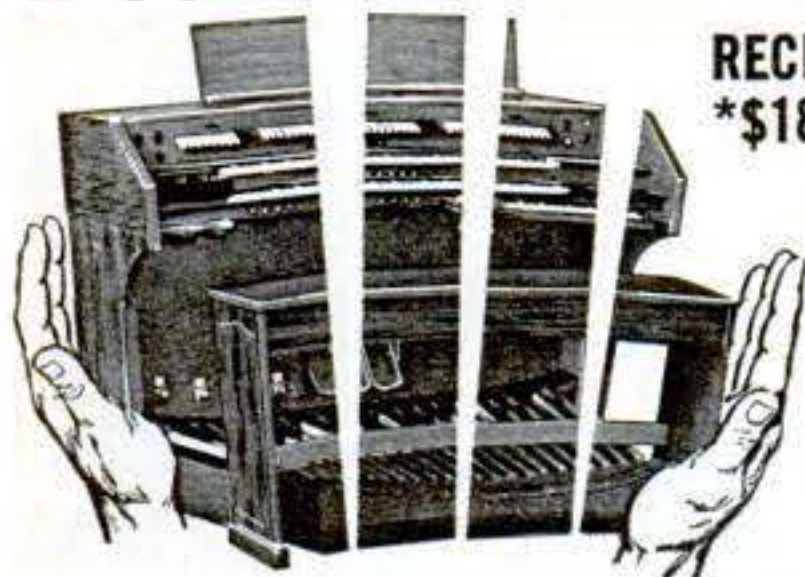
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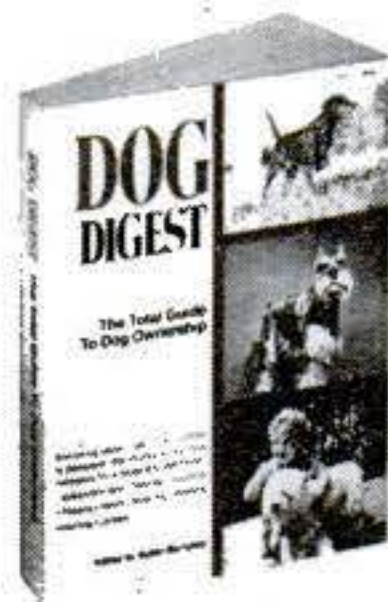
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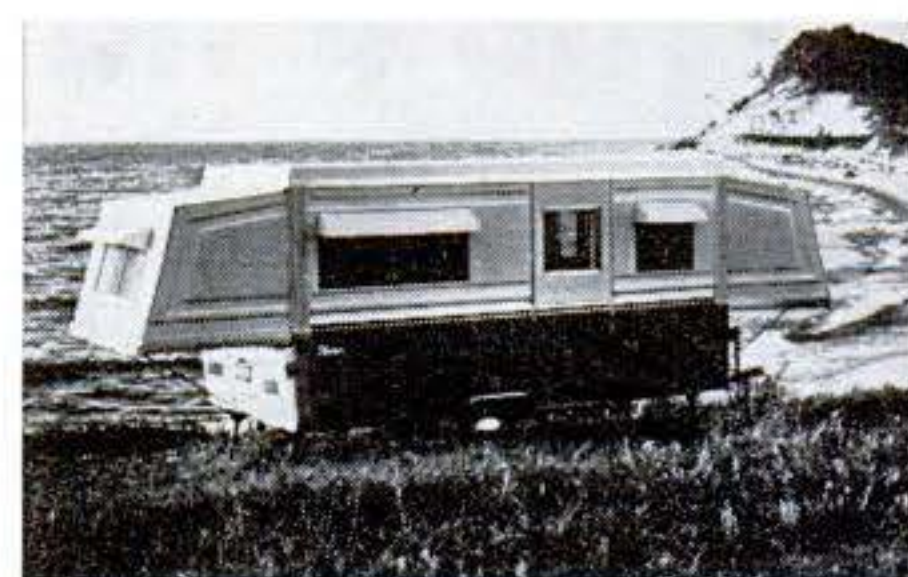
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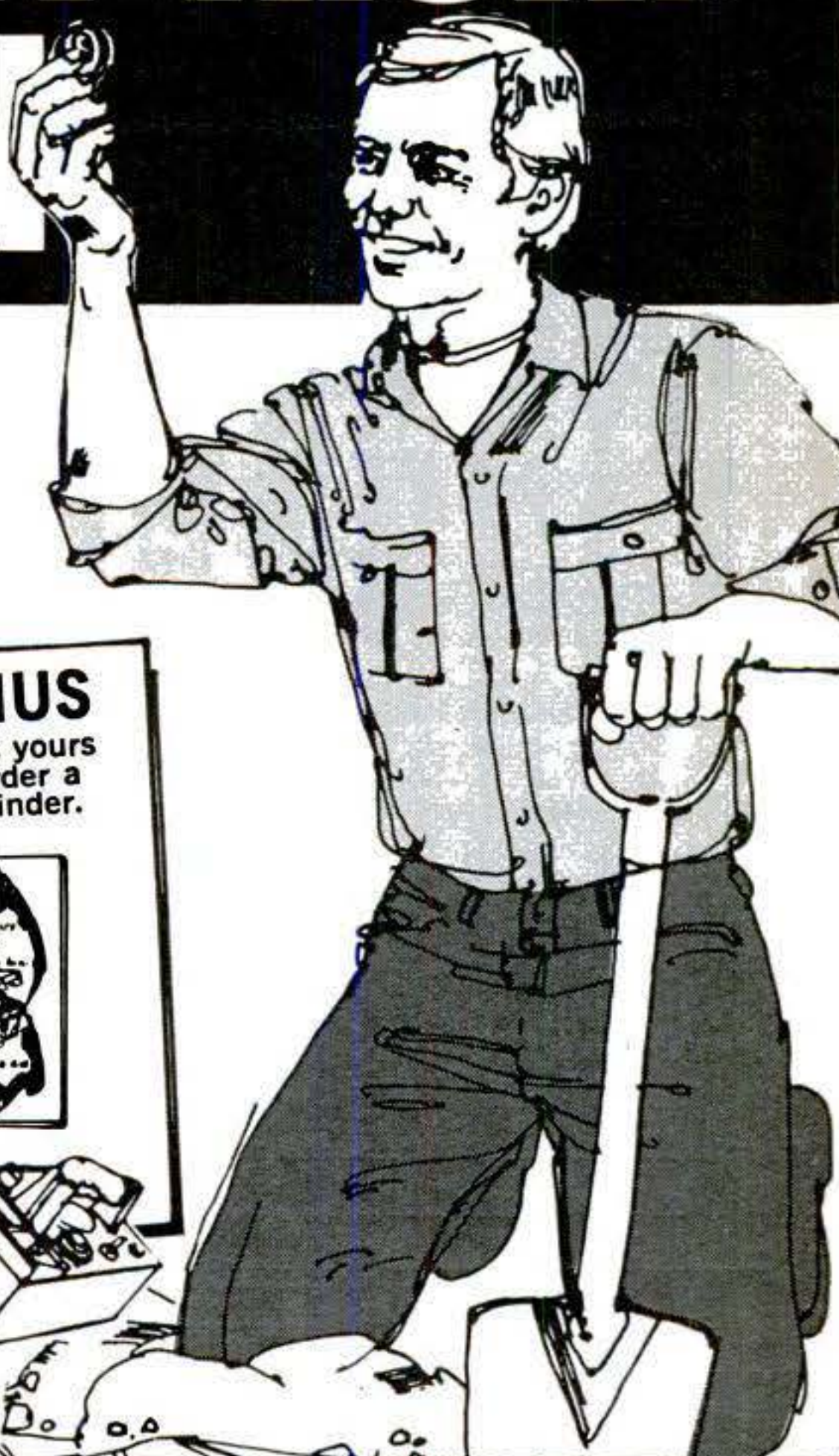
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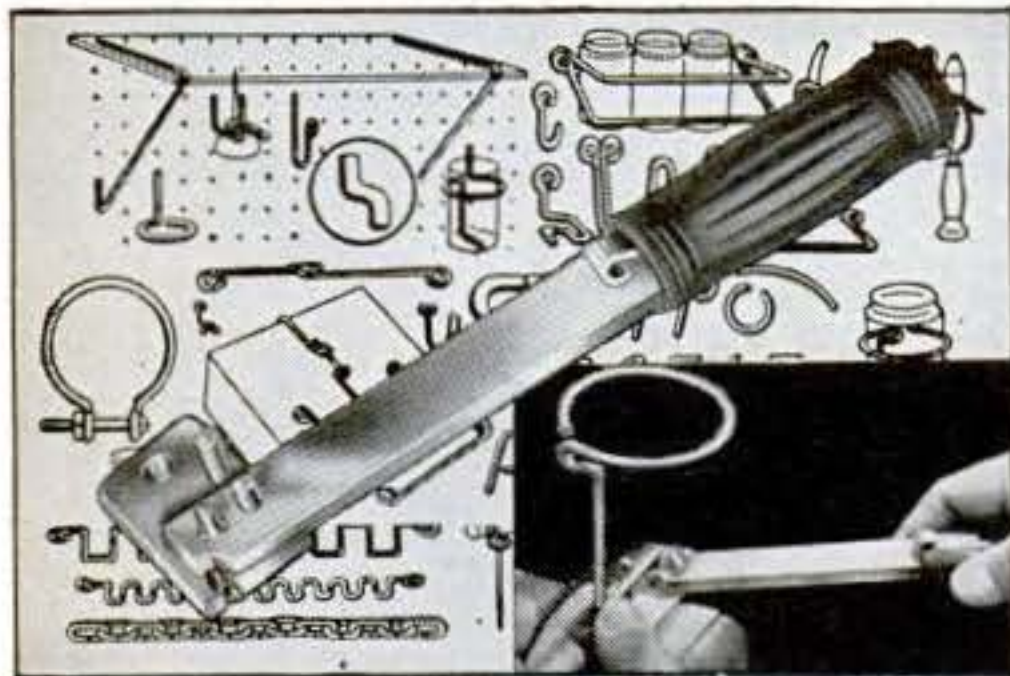
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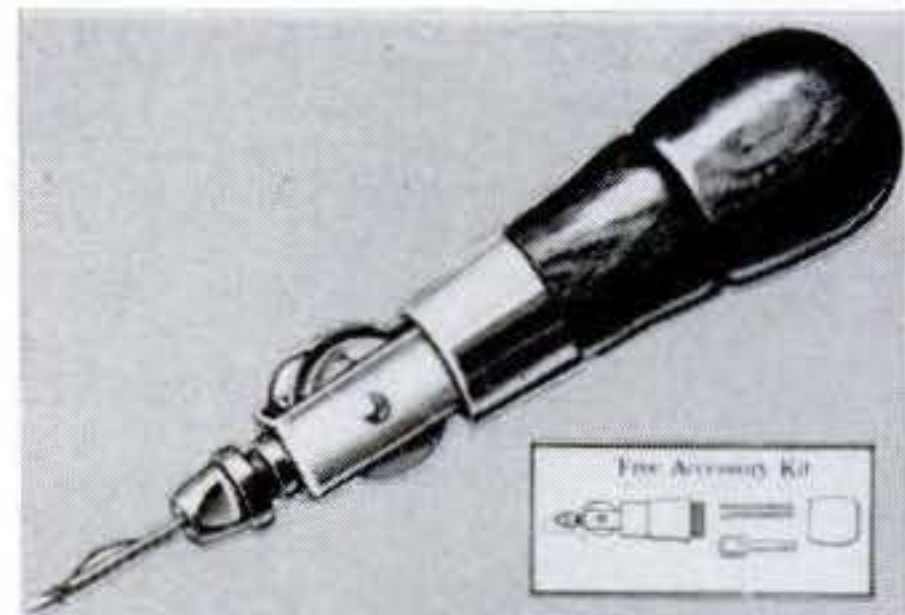
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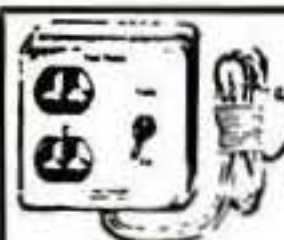
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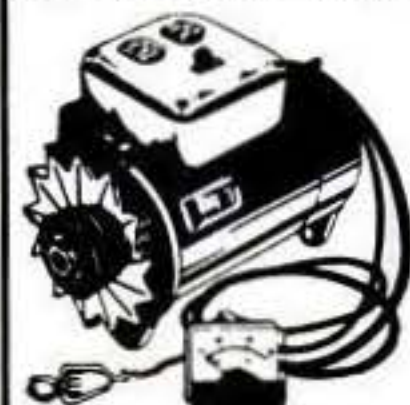
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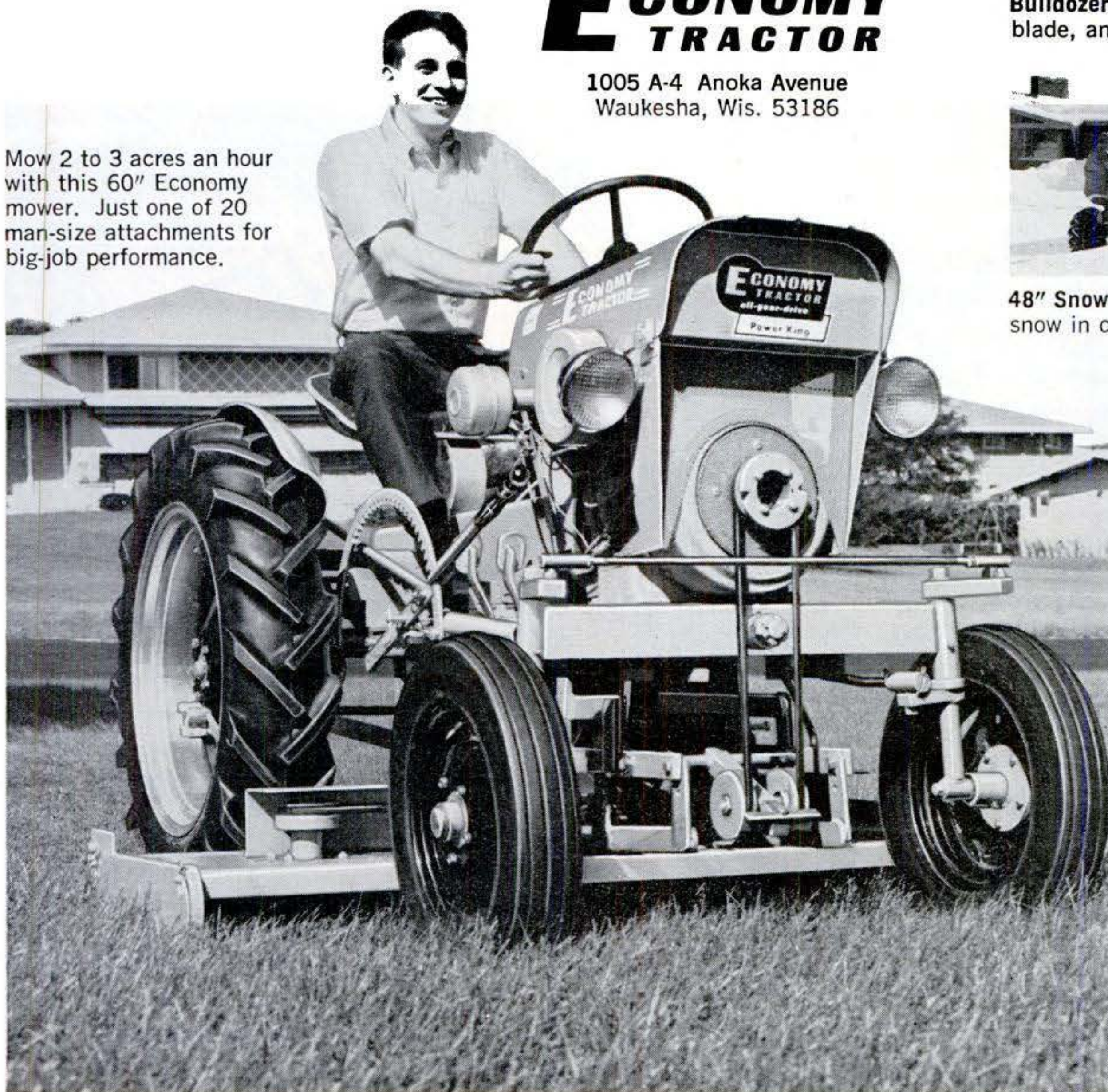
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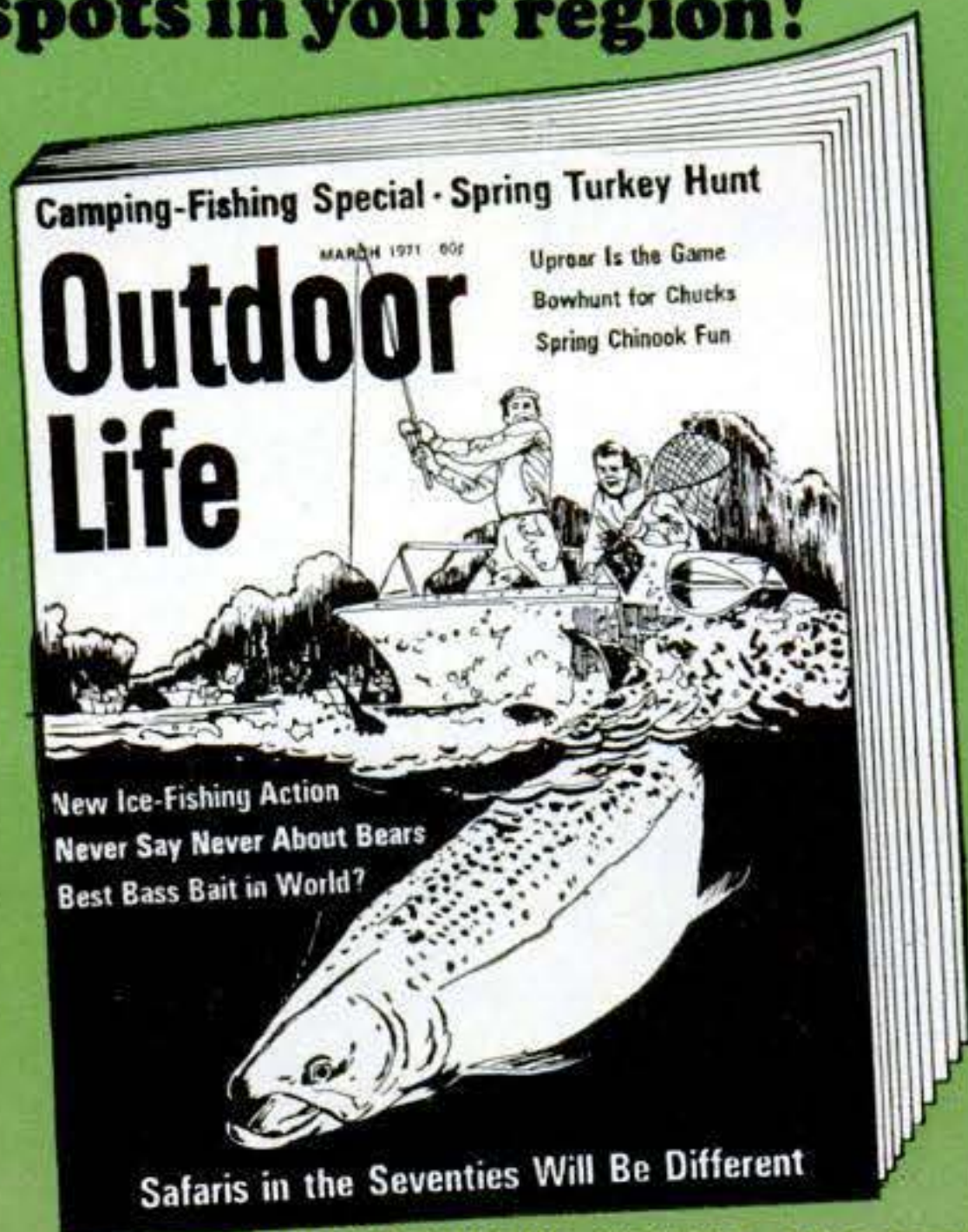
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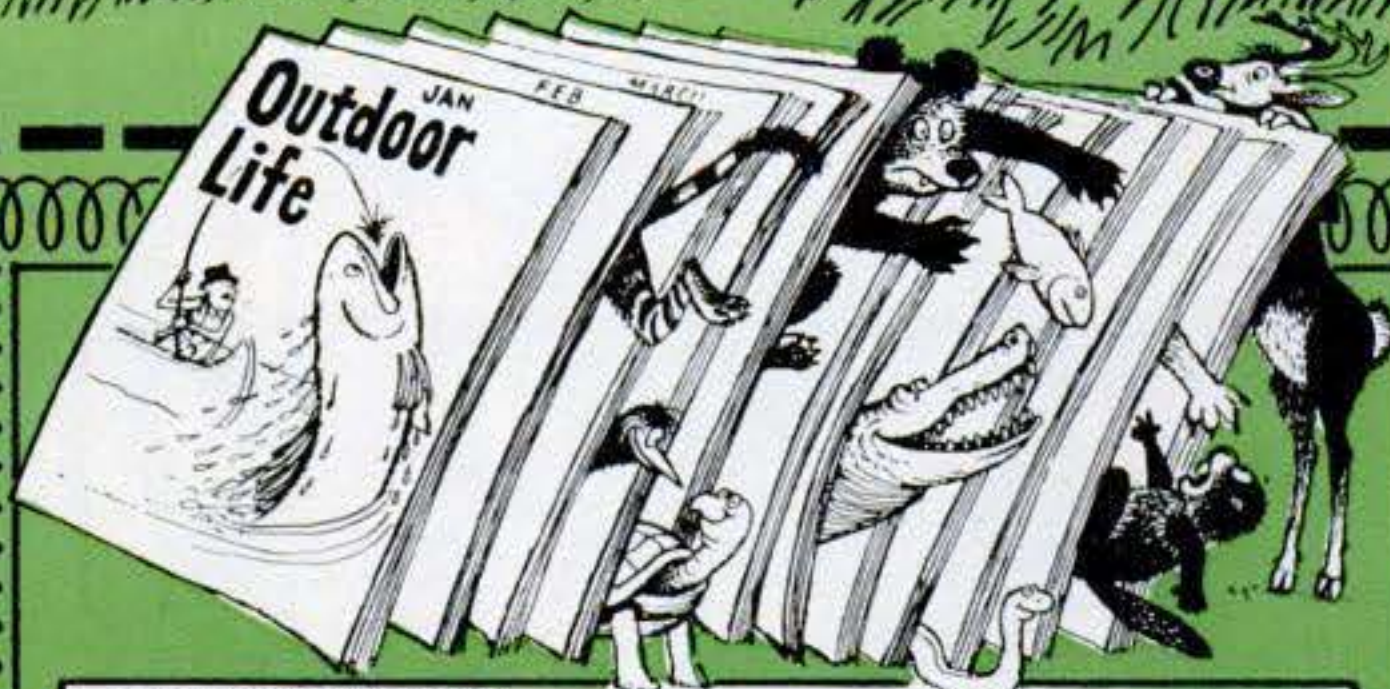


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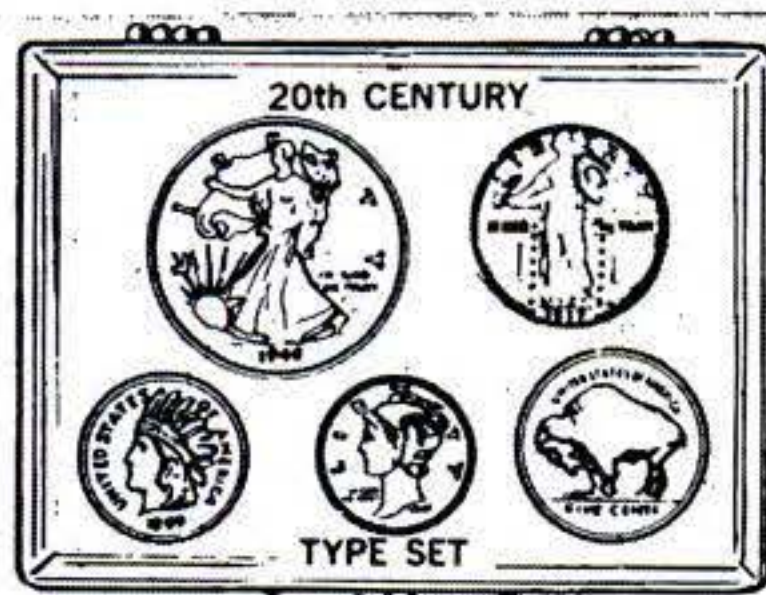
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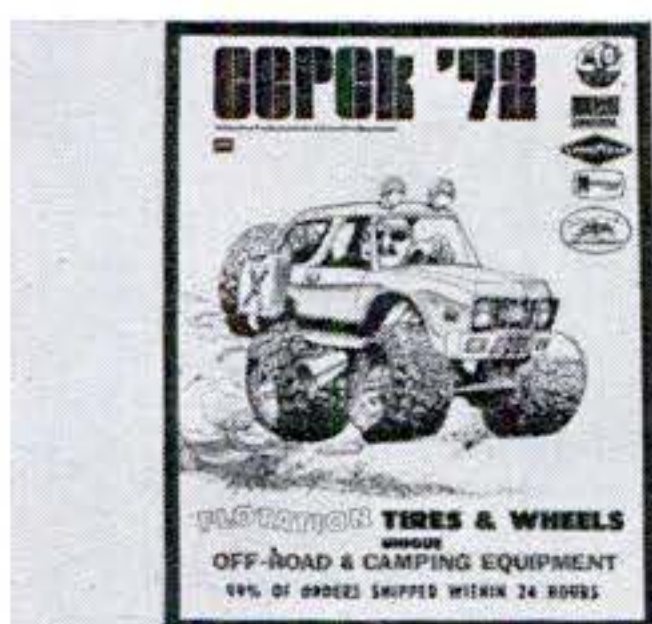
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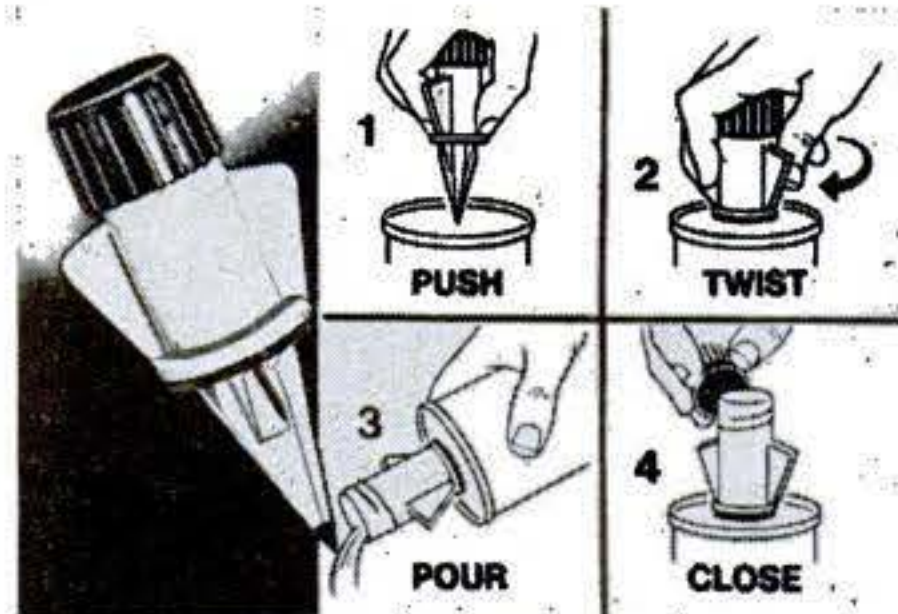
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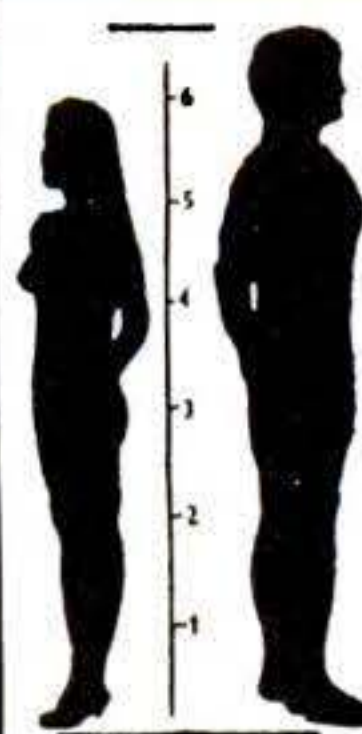
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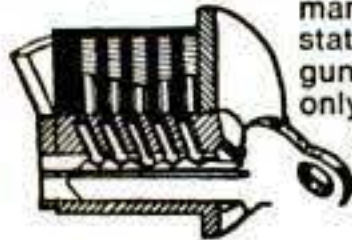
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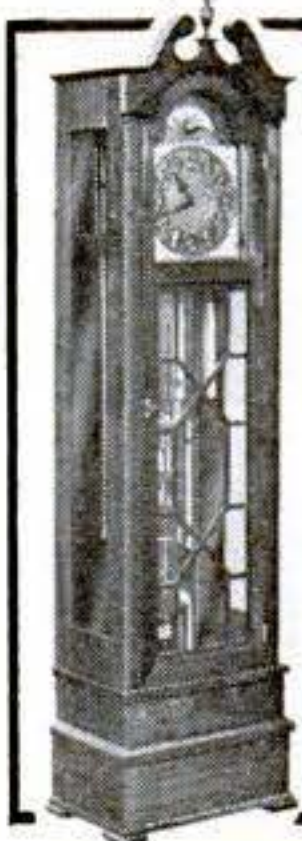
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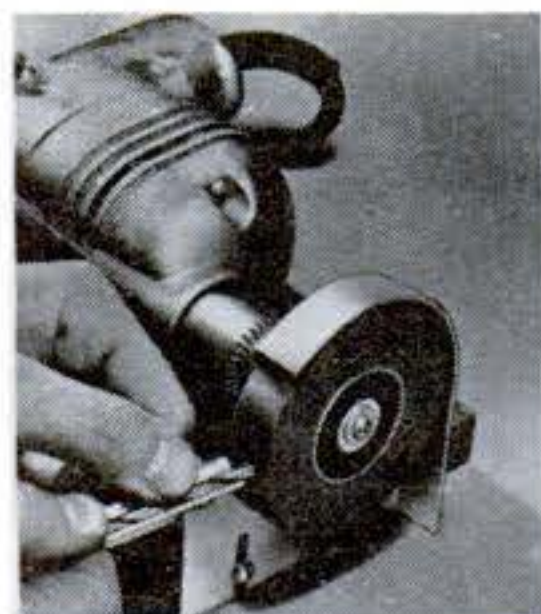
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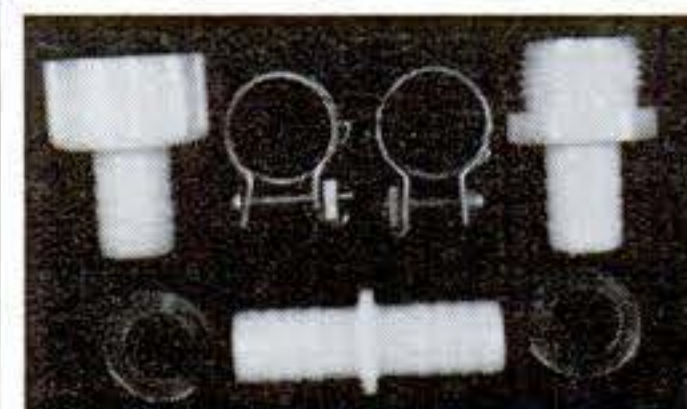
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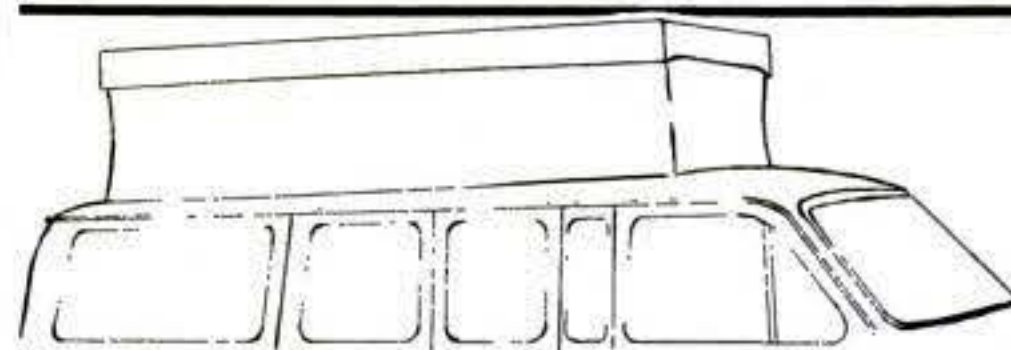


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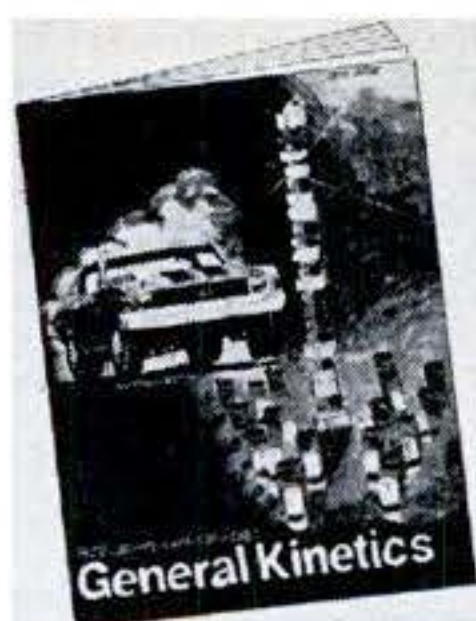
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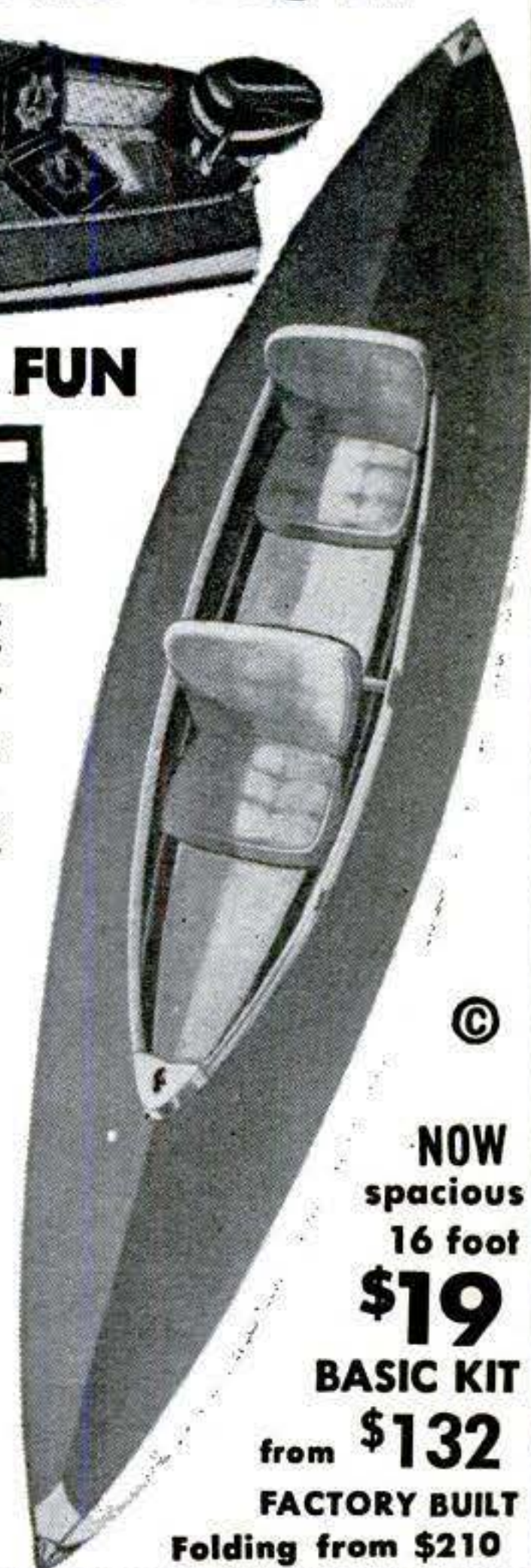
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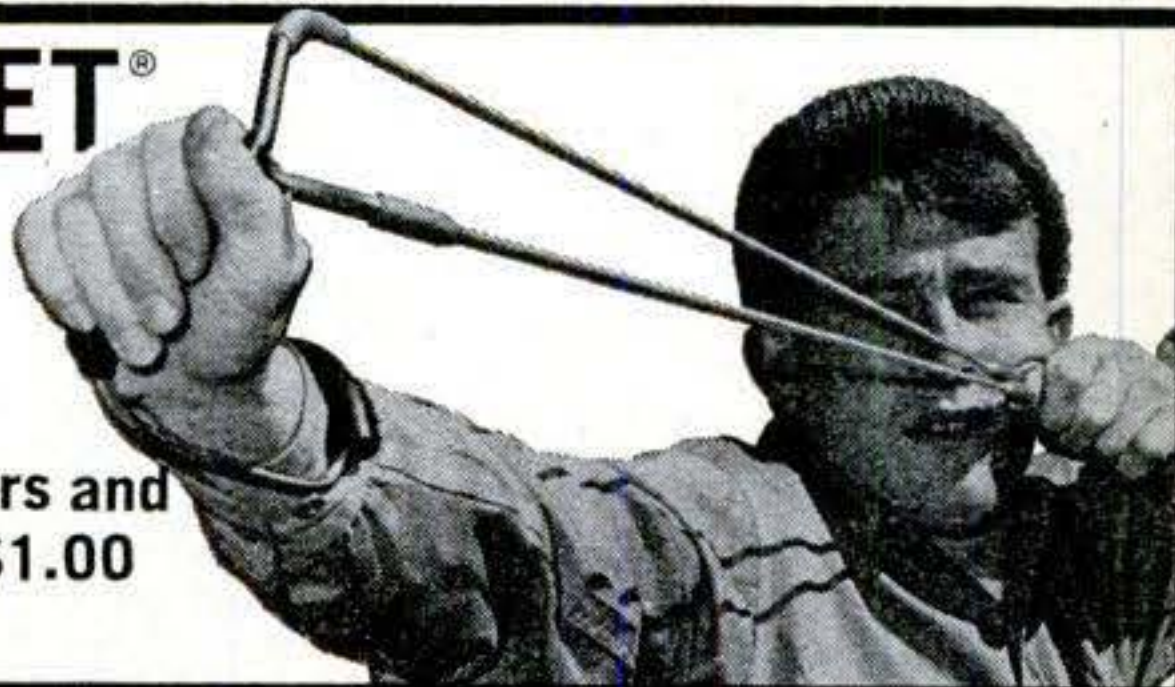


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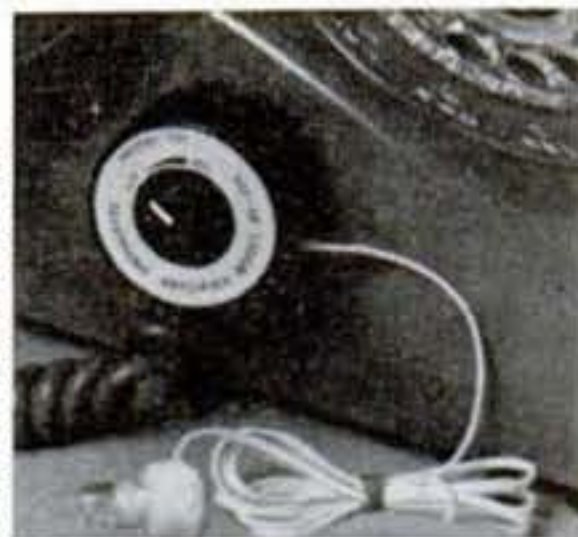
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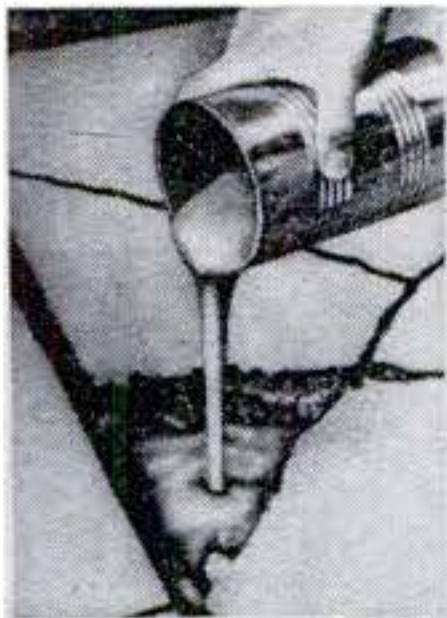
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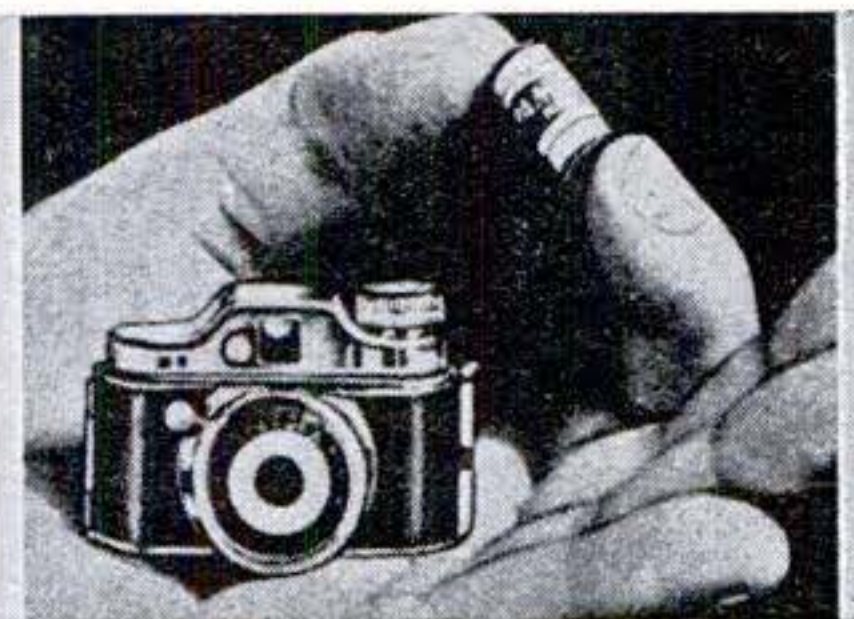
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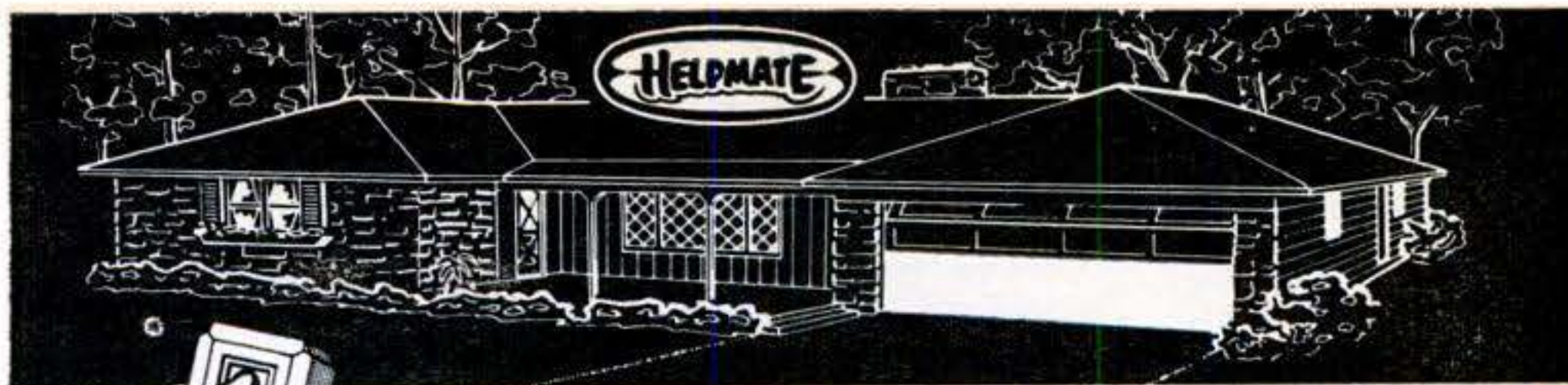
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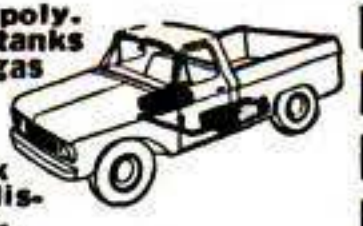
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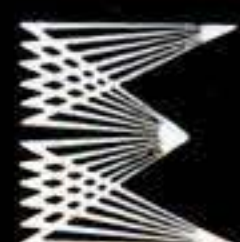
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